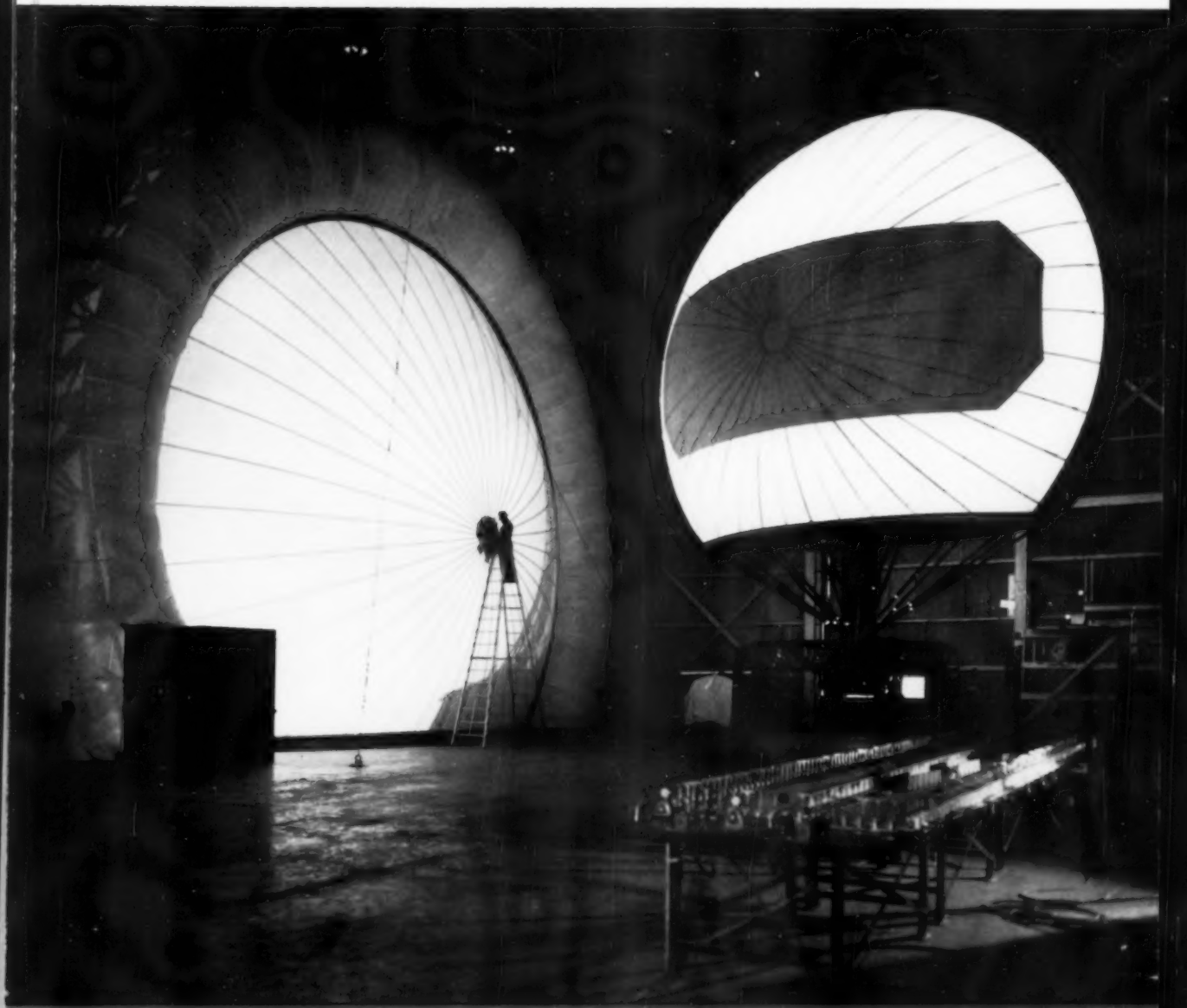
AVIATION WEEK

A McGRAW-HILL PUBLICATION

October 22, 1956 50 cents

Paraballoon: New And Radical Radar Antenna

Paraballoons



NACA's Mach 10 Test Rockets

PROTECTION FOR YOU

"Beyond the Wild Blue Yonder"

For your protection, Convair's delta-wing F-102A Interceptor is now flying with the U.S.A.F. Air Defense Command. It reaches far into the stratosphere in a supersonic hurry – pinpointing an invader in any kind of weather, at any time of day or night!

Through *Engineering to the Nth power,* Convair's F-102A has conquered time and distance, extending freedom's protective barrier – far *beyond the wild blue yonder!*

CONVAIR

A DIVISION OF GENERAL DYNAMICS CORPORATION

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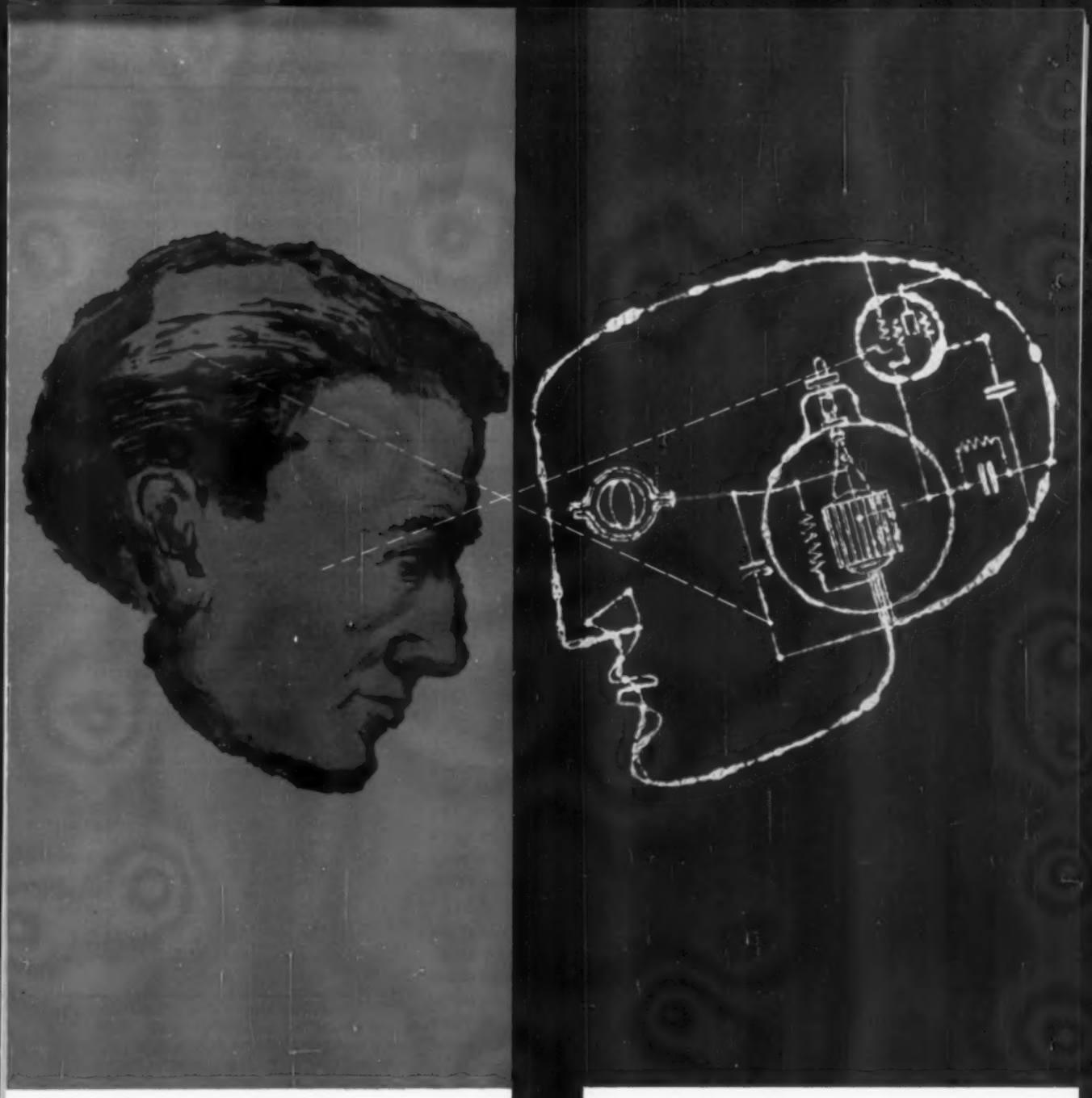

HOW TO IMPROVE A MISSILE'S IQ

Today's guided missile is an amazingly sophisticated and intelligent instrument, capable of complex thought and precise action. Tomorrow's must have an even higher IQ.

To improve a missile's intelligence, Fairchild Guided Missiles Division engineers and scientists have developed radical new concepts for guidance and control, transferring their intelligence into the missile's guidance center.

Through sound research, inventiveness and imagination, FGMD engineers and scientists continue to make great strides in all fields of missile development...putting *more brain-power* into *more missile power.*

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HOT SPOTS

IN YOUR ASSEMBLIES

BOURNS *Model 160*

TRIMPOT®

—new high temperature, high power design

This instrument operates reliably in high ambient temperatures, or wherever closely massed components generate localized hot spots. The TRIMPOT will withstand temperatures up to 175° C. (347° F.) with unimpaired efficiency. Lead wires are Teflon insulated. High power dissipation— 0.6 watt at 50° C. (122° F.)

You'll find every outstanding feature of the original Model 120 TRIMPOT—standard of the industry—built into the Model 160. 25-turn adjustments are made with a screwdriver on the slotted shaft. The shaft is self-locking, to provide stable settings. Resistance element is precision wound with low temperature-coefficient resistance wire. Unit withstands severe shock, vibration and acceleration. To assure its dependable performance under extreme environmental conditions, Bourns designed the Model 160 TRIMPOT to meet or exceed rigid government specifications.

Write for new descriptive literature.

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General Offices: 6135 Magnolia Avenue Riverside, California
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AVIATION CALENDAR

Oct. 23-25—National Business Aircraft Assn. Ninth Annual Meeting and Forum, McAllister-Columbus Hotel, Miami, Fla.

Oct. 25-26—Aircraft Electrical Society Annual Equipment Display, Pan Pacific Auditorium, Los Angeles, Calif.

Oct. 25-26—Second Annual Technical Meeting, Institute of Radio Engineers Professional Group on Electron Devices, Shoreham Hotel, Washington 25, D. C.

Oct. 29-30—Third Annual East Coast Conference on Aeronautical and Navigational Electronics, Fifth Regiment Armory, Baltimore, Md.

Oct. 31-Nov. 1-2—1956 Annual Meeting and Exhibit Society for Experimental Stress Analysis, Deshler-Hilton Hotel, Columbus 1, Ohio.

Nov. 1-2—20th Anniversary National Time and Motion Study and Management Clinic, sponsored by Industrial Management Society, Sherman Hotel, Chicago.

Nov. 12-15—Thirty-Sixth Annual Meeting, American Petroleum Institute, Hotels Conrad Hilton, Palmer House and Sheraton Blackstone, Chicago, Ill.

Nov. 13-14—Sixth Transport Aircraft Hydraulic Conference, sponsored by Vickers, Inc., Park Shelton Hotel, Detroit.

Nov. 14-16—Symposium on Optics and Microwaves, sponsored by the Institute of Radio Engineers Professional Group on Antennas and Propagation, Lisner Auditorium, George Washington University, Washington, D. C.

Nov. 14-16—Latin American Aviation Conference, sponsored by Export Committee, Aircraft Industries Assn., Miami, Fla.

Nov. 15—Conference on problems and issues concerned with control and protection of airport approaches, sponsored by Institute of Transportation and Traffic Engineering, University of California, International House, University of California, Berkeley, Calif.

Nov. 15-16—Metropolitan New York Material Handling Conference, sponsored by N. Y. Chapter of the American Material Handling Society, Brooklyn Polytechnic Institute, Brooklyn, N. Y.

Nov. 16-17—Air Mail Pioneers Eastern Division Reunion, Ambassador Hotel, Washington, D. C.

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Vol. 65, No. 17

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One in a series about users of Phillips 66 Aviation Products

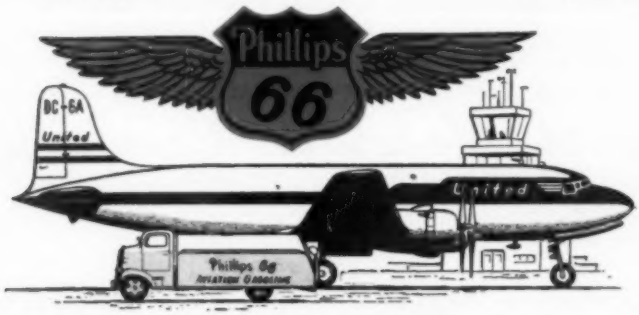
Phillips 66 LOOKS AHEAD with UNITED

"We made a $5,500,000 investment in the future of air freight." That is the statement of R. L. Mangold, manager of cargo sales, United Air Lines. Mr. Mangold referred to United's recent addition of five new DC-6As to its cargo fleet. This addition to its DC-4 Cargoliners will expand United's all-cargo productivity from 125,000 to 225,000 ton miles daily. The 5-mile-a-minute DC-6A cargo carriers will fly coast-to-coast in less than a half a day, including an en route stop; they will cut 6 hours westbound and 5⅓ hours eastbound from transcontinental flights.

ACCENT ON SPEED; *cruising speed of 300 miles an hour and quick loading through oversize main cabin door assure swift delivery of mail, freight, express.*

HUGE MAIN CABIN *has 4,433 cubic feet of space, more than 200 tie-down rings and is pressurized. Temperature control permits range of 40 to 70 degrees.*

LARGE-SIZE OBJECTS, *hitherto restricted from air shipment, fit easily into the spacious cabin of United's DC-6A. Cargo capacity is 30,000 pounds.*



● Today, Phillips 66 Aviation Gasoline gives dependable, efficient performance to United and other leading air lines, as well as to the military air services.

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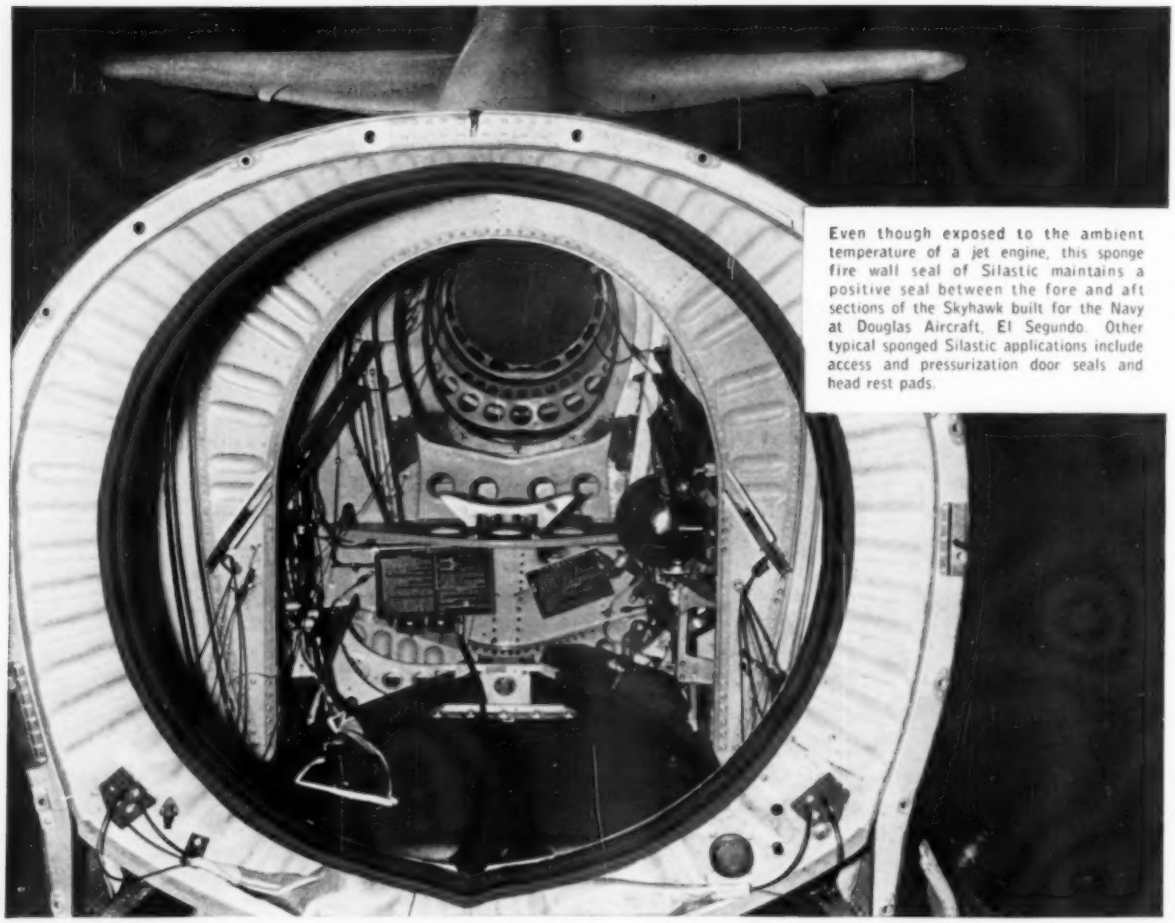

Even though exposed to the ambient temperature of a jet engine, this sponge fire wall seal of Silastic maintains a positive seal between the fore and aft sections of the Skyhawk built for the Navy at Douglas Aircraft, El Segundo. Other typical sponged Silastic applications include access and pressurization door seals and head rest pads.

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SILICONE RUBBER

sponge stays resilient from −130 to 500 F

Wherever performance can be improved or equipment made safer with a sponge rubber that retains its physical properties regardless of heat, cold, ozone or weather . . . a sponge made of Silastic,* Dow Corning's silicone rubber, is the answer. Available now in most any size, shape or color from leading rubber companies.

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Typical Properties of Silastic Sponge

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• Structure	Closed cell

• Lightweight • Flexible • Weather resistant

If you consider ALL the properties of a silicone rubber, you'll specify SILASTIC.

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NEW

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Miniaturized

PISTON TYPE HYDRAULIC PUMPS

3000 psi . . . CONSTANT DISPLACEMENT

These new miniaturized hydraulic pumps were developed by Vickers for limited life applications such as missile and ram air turbine driven hydraulic systems . . . also for motorpump assemblies supplying emergency power on aircraft.

A distinctive feature is adaptability to manifolding and special mounting. This permits integration with the balance of a "packaged" hydraulic system to provide hydraulic power in the most compact and lightweight form yet devised. Some sizes are capable of delivering more than five horsepower per pound of weight.

Available in four size series, this miniaturized pump has the same basic characteristics as the standard Vickers piston type pump which has been establishing outstanding performance records on aircraft since 1940. Ask nearest Vickers Aircraft Application Engineer for further information.

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TELEGRAMS: Vickers WUX Detroit • TELETYPE "ROY" 1149
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OVERSEAS REPRESENTATIVE: The Sperry Gyroscope Co., Ltd.—Great West Road, Brentford, Middx., England

Engineers and Builders of Oil Hydraulic Equipment Since 1921

This Hydraulic Pump has 4.3 hp output @ 3000 psi and 12,000 rpm. Weight 0.9 lb.

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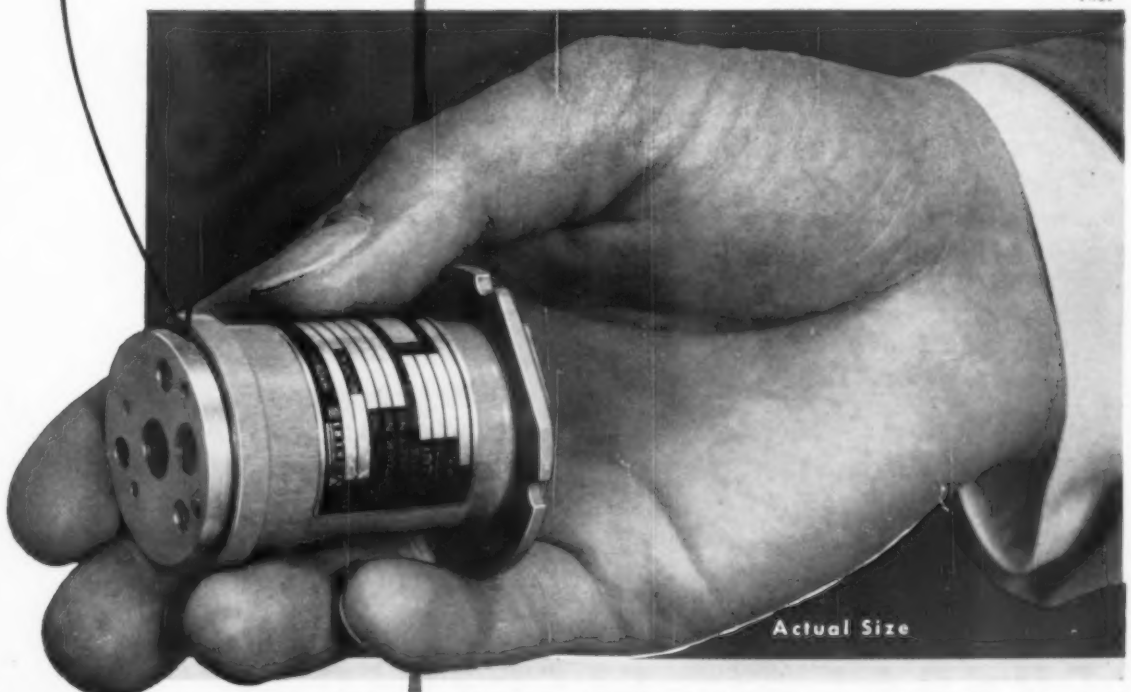


A large expansion program now in its early stages means large opportunities for additional engineers at Vickers. Write for information.

READY FOR ACTION

DOUGLAS B-66, ALL-WEATHER TACTICAL BOMBER TAKES OFF FOR PRACTICE MISSION

B-66, Protected by General Electric Automatic, Electronic Tail Armament Gives TAC Greater Mobility, Flexibility

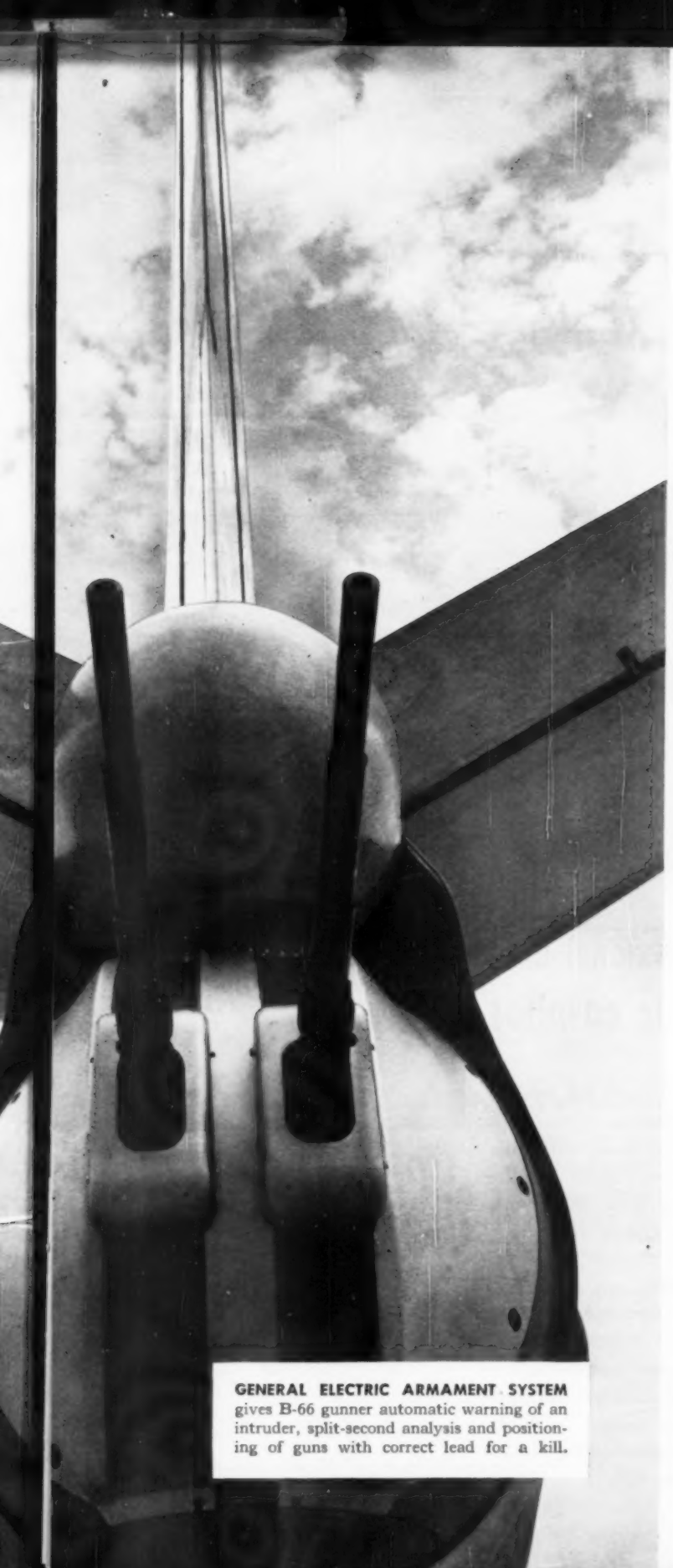
Built for high-speed interdiction and reconnaissance, the Douglas B-66 is the latest addition to the Tactical Air Command's offensive power. General Electric's MD-1, electronic tail armament system provides an accurate, defensive punch to help the all-weather bomber accomplish its mission.

To assure optimum integration of components and continuously high performance of the equipment in the field, the system is completely assembled and tested at the factory and followed through operational usage by highly skilled General Electric technicians. General Electric's complete, follow-through service helps keep the B-66 tail defense system truly "ready for action"—ready to counter with speed, precision, and reliability. 222-5

ENGINEERS: Expanding electronic bomber defense projects at G.E. are creating opportunities for you. Contact C. E. Irwin, Aircraft Products Department, General Electric Company, Johnson City, N.Y.

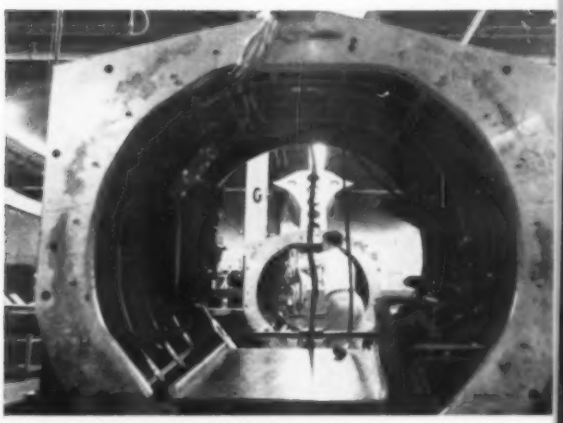
Progress Is Our Most Important Product

GENERAL ELECTRIC

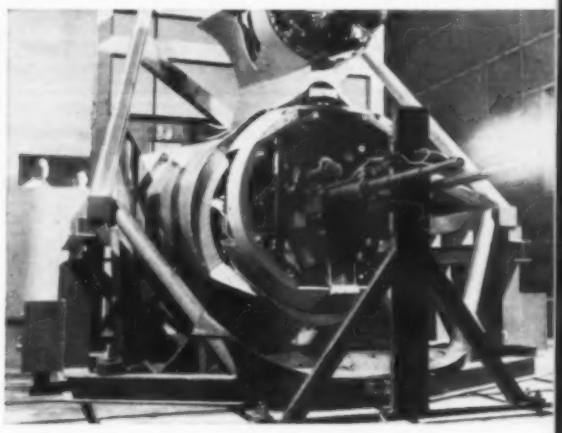


GENERAL ELECTRIC ARMAMENT SYSTEM gives B-66 gunner automatic warning of an intruder, split-second analysis and positioning of guns with correct lead for a kill.

OVER-ALL CAPABILITY OF G.E.'s AIRCRAFT PRODUCTS DEPARTMENT ASSURES READY-FOR-ACTION SYSTEMS

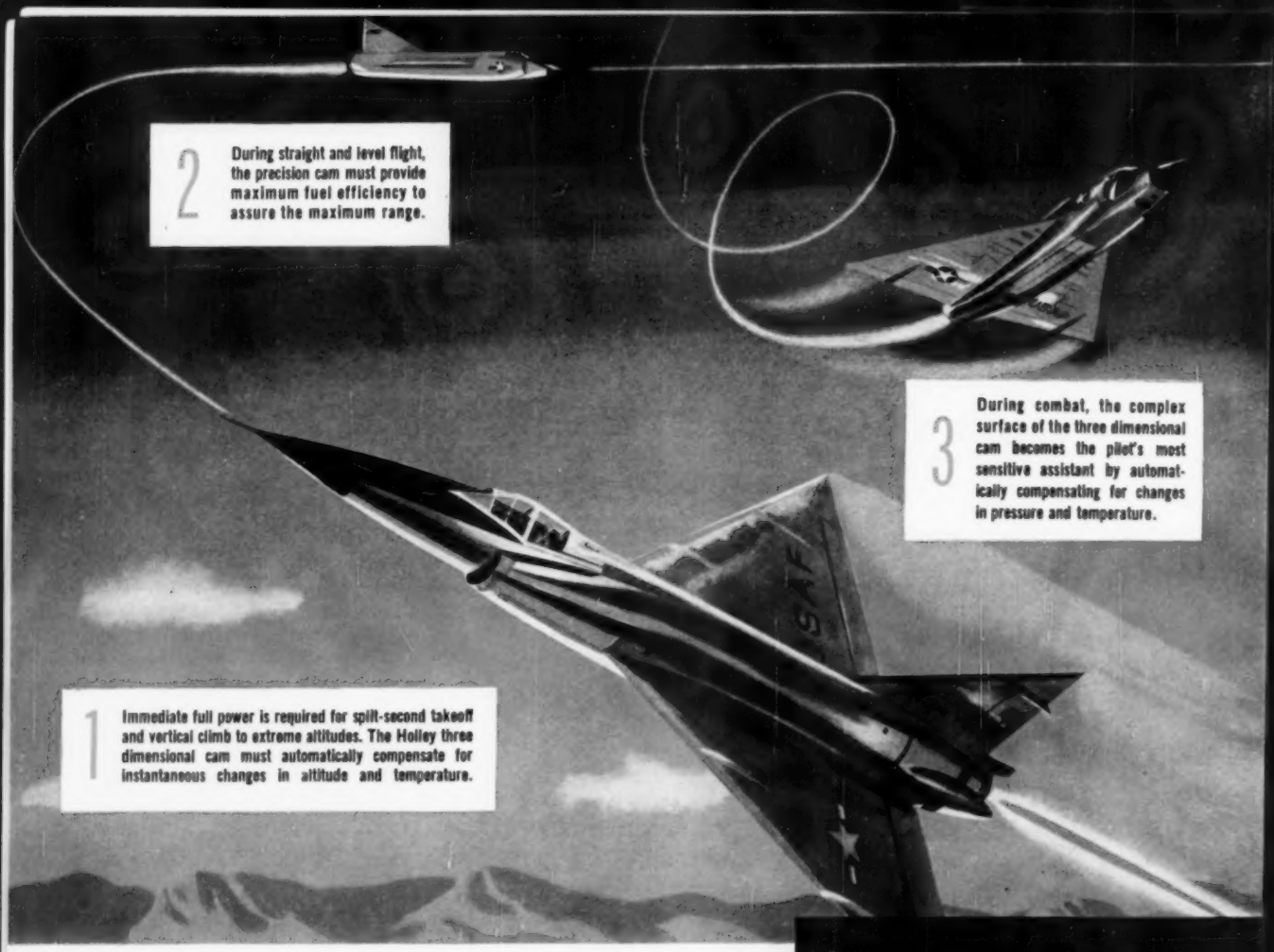


COMPLETE TAIL TURRET PACKAGE, made up of G-E radar computer and gun turret, is assembled for shipment to Douglas for incorporation into B-66 airframe.



FIRE TESTING of assembled tail turret in indoor range assures delivery of "combat ready" defense system for the aircraft's first flight.

SERVICE ENGINEERS help Air Force attain maximum armament maintenance standards, provide G-E designers with field data to speed improvements.

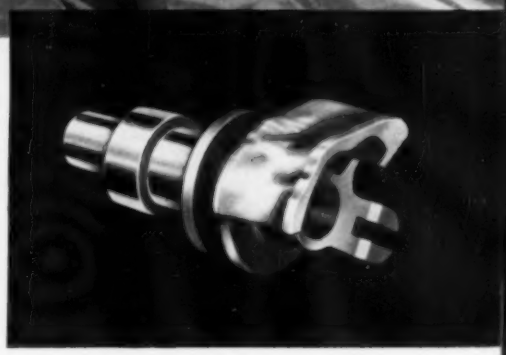

2 During straight and level flight, the precision cam must provide maximum fuel efficiency to assure the maximum range.
3 During combat, the complex surface of the three dimensional cam becomes the pilot's most sensitive assistant by automatically compensating for changes in pressure and temperature.
1 Immediate full power is required for split-second takeoff and vertical climb to extreme altitudes. The Holley three dimensional cam must automatically compensate for instantaneous changes in altitude and temperature.

How the Holley three dimensional cam functions as an automatic co-pilot

The job of the Holley Power Control for jet aircraft is to sensitively control engine power according to the pilot's requirements and, at the same time, make automatic adjustments for split-second variations in altitude, pressure and temperature. The "brain center" of advanced Holley controls is a three dimensional cam which is so contoured that it can adapt itself to all combinations of atmospheric temperature and pressure, from Thule to the Equator and from sea level to extreme altitudes.

In addition to the automatic compensations made for the pilot by the three dimensional cam, it interprets the pilot's request for changes in power. It's the most important link between cockpit and engine.

The three dimensional cam, like the power control itself, is designed, engineered and manufactured by Holley—one of the world's foremost power control manufacturers.



Typical "brain center" of a Holley aircraft engine control. Note the delicate machined surfaces. Each plays a vital role in mechanically regulating the engine under varying conditions.

HOLLEY Carburetor Co.

11955 E. Nine Mile Road • Van Dyke, Michigan

LEADER IN THE DESIGN, DEVELOPMENT, AND MANUFACTURE OF AVIATION FUEL METERING DEVICES

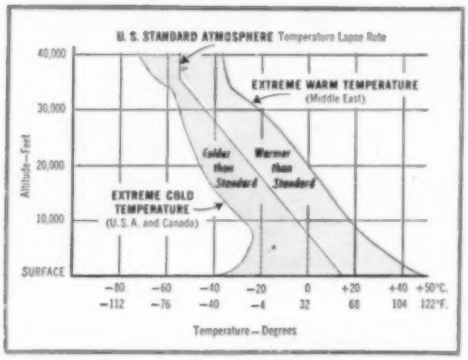
A-23

FLY WEATHER-WISE

These weather items prepared in consultation with the United States Weather Bureau

TURBO-PROP OPERATION

Fuel Requirements in Warm and Cold Climes



Graph shows temperature variations for warm and cold areas—on ground and at operating altitudes.

In turbo-prop operation, payload and fuel performance are closely tied together. When selecting the fuel's characteristics, ground temperatures in area of operation play an important part.

COLD CLIMES—Trans-Canada's Viscount planes are based in areas where winter ground temperatures drop as low as −46°F. Under these conditions, they use Mobiljet 4. With a freeze point of −76°F. it is free-flowing at lowest temperatures . . . easy to pump and won't clog filters.

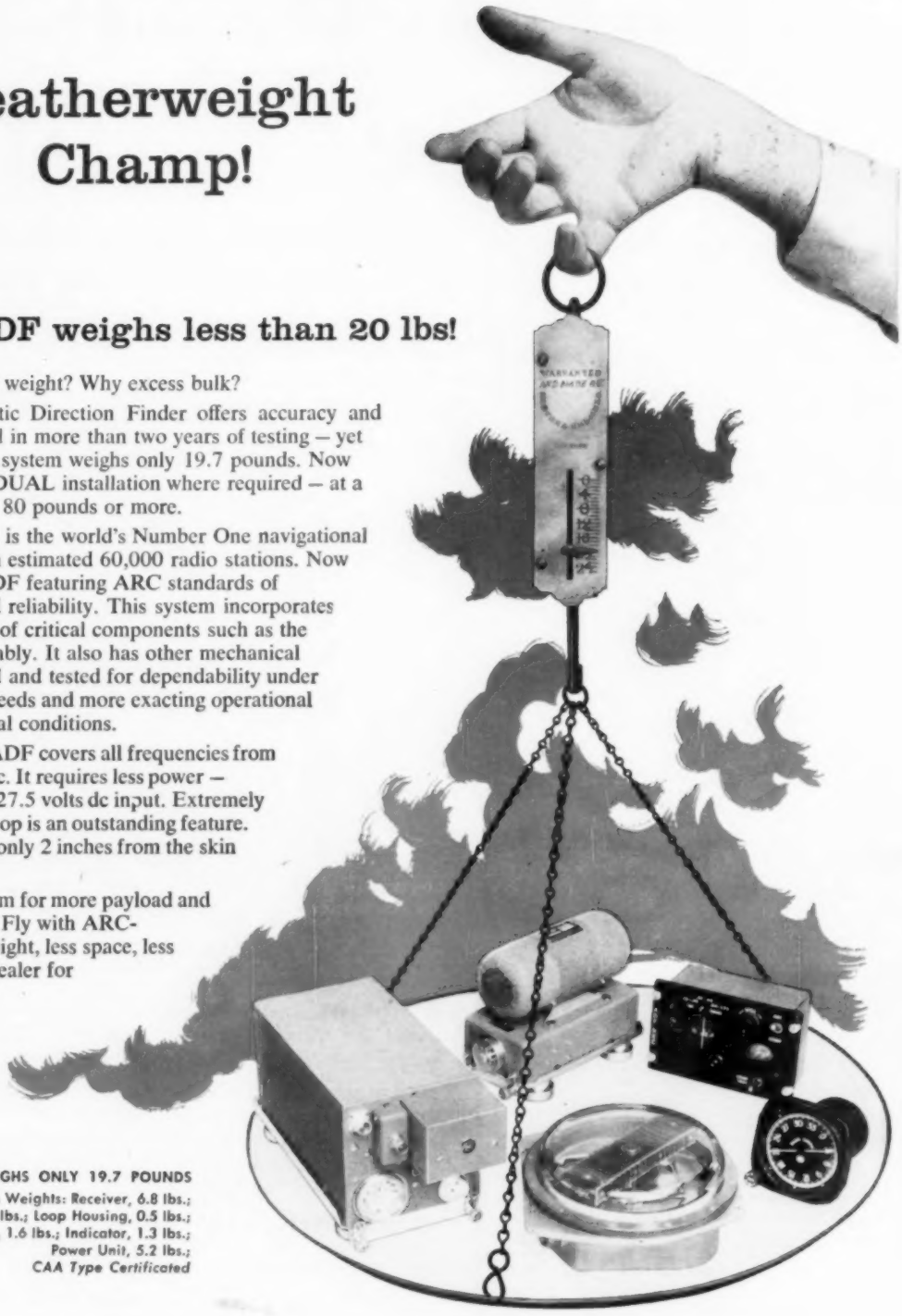
WARM CLIMES: In warmer climes where the ground temperature problem is not acute, Middle East Airlines get top performance from its Viscounts with Mobiljet 1.

Each of these high-grade fuels possesses the outstanding quality and uniformity that help you get the most economical operation . . . insure maximum payload and scheduled departures at all times.

For Top Flight Performance—Make it **Mobil**

SOCONY MOBIL OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM CO. GENERAL PETROLEUM CORP., MOBIL OVERSEAS OIL CO., INC.

Featherweight Champ!



ARC's ADF weighs less than 20 lbs!

Why carry dead weight? Why excess bulk?

This Automatic Direction Finder offers accuracy and reliability proved in more than two years of testing – yet the entire 5-unit system weighs only 19.7 pounds. Now you can have a DUAL installation where required – at a weight saving of 80 pounds or more.

The ADF still is the world's Number One navigational aid, usable on an estimated 60,000 radio stations. Now you can have ADF featuring ARC standards of performance and reliability. This system incorporates hermetic sealing of critical components such as the entire loop assembly. It also has other mechanical features designed and tested for dependability under today's higher speeds and more exacting operational and environmental conditions.

The Type 21 ADF covers all frequencies from 190 kc to 1750 kc. It requires less power – only 2.8 amps at 27.5 volts dc input. Extremely low drag of the loop is an outstanding feature. Housing extends only 2 inches from the skin of the aircraft.

Now make room for more payload and other equipment. Fly with ARC-reliability, less weight, less space, less drag. Ask your dealer for complete details.

TYPE 21 ADF WEIGHS ONLY 19.7 POUNDS

Component Units Weights: Receiver, 6.8 lbs.; Loop, 4.3 lbs.; Loop Housing, 0.5 lbs.; Control Unit, 1.6 lbs.; Indicator, 1.3 lbs.; Power Unit, 5.2 lbs.;
CAA Type Certificated

Dependable Airborne Electronic Equipment Since 1928

Aircraft Radio Corporation BOONTON, NEW JERSEY

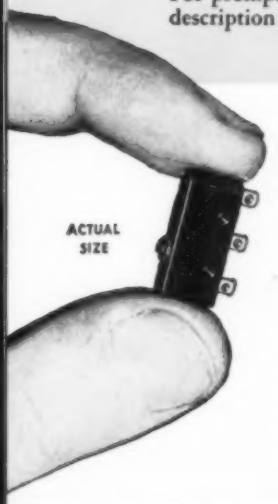
Omni/ILS Receivers • Course Directors • UHF and VHF Receivers and Transmitters
LF Receivers and Loop Direction Finders • 10-Channel Isolation Amplifiers • 8-Watt Audio Amplifiers • Interphone Amplifiers • Omnirange Signal Generators and Standard Course Checkers • 900-2100 Mc Signal Generators

Electro-Snap Switches Can Be Adapted to Almost Any Job — Quickly, Easily, Economically

Switching Problem?

Just choose the Electro-Snap Basic Switch that meets your electrical requirements, add the proper actuator — and presto! — you have a tailor-made precision switch that exactly fits your application. Electro-Snap makes a wide variety of stock actuators to fit almost any requirement. And our engineering department is at your service if a standard combination "won't fill the bill."

For prompt action on your switching problems, send us a brief description and rough sketch of the switch you need.



SUB-MINIATURE SWITCHES TYPE E-4

S.P.D.T., 1 circuit; 5 amps, 125/250 v. AC Operating force 150 grams max. Exceptionally vibration-resistant. Special model E4-7 is stabilized for — 65° to + 350° F. operation.

Write for data sheet EM-10

Push Button Actuator

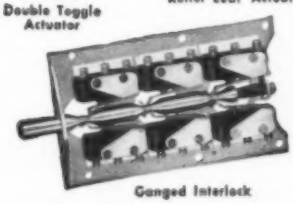
Toggle Actuator (Momentary or Constant Contact)

Double Toggle Actuator

Roller Leaf Actuator

Leaf Actuator

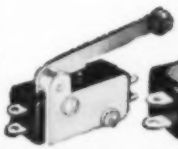
Extension Leaf Actuator

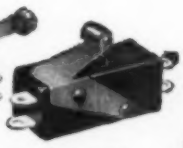

Ganged Interlock

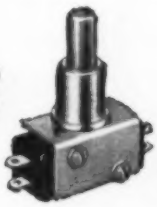
TYPE S SWITCHES Series S1

S.P.D.T., 2 circuit; 10 amps, 125/250 v. AC/ 30 v. DC. Ind. Screw or solder terminals on ends or one side of switch. Also available with reset button at bottom of switch or in Type S-100 Make-Before-Break Series where switch completes a new circuit before interrupting old one.

Write for data sheet STM-10

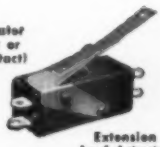

Roller Lever Actuator

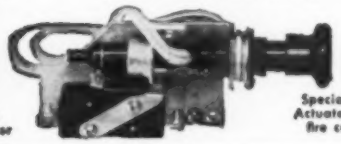

Roller Actuator

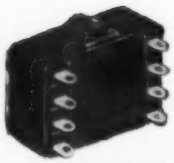


Push Button Actuators (Various button sizes available)

Toggle Actuator (momentary or constant contact)


Extension Leaf Actuator

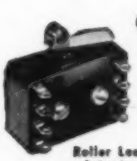

Special Push Button Actuator designed for fire control system

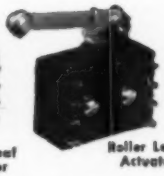


Write for data sheet DM-10

DOUBLE-POLE SIMULTANEOUS ACTION TYPE D-8

D.P.D.T., 4 Circuit
15 amps, 125/250 v. AC.
10 amps, 30 v. DC Ind.
Eight terminals and four separate circuits which operate simultaneously permits switch to reverse 3-phase motors, replace expensive relays, etc.


Roller Leaf Actuator


Roller Lever Actuator

Leaf Actuator

Extension Leaf Actuator

Push Button Actuators (Various button sizes available)

HERMETICALLY-SEALED DOUBLE-POLE SWITCH

Write for data sheet HTJM-10

Type J2-4

Toggle Actuator for J2-4

D.P.D.T., 4 circuit 10 amps, 125/250 v. AC/30 v. DC.

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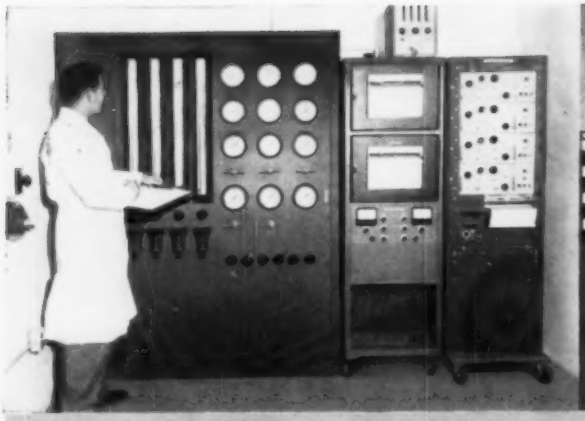
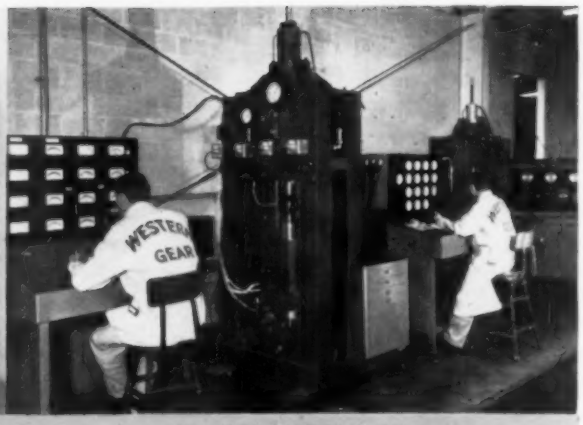
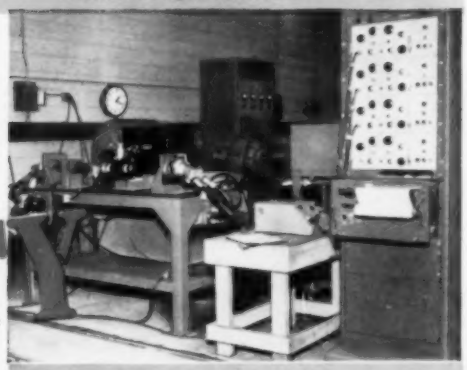


Instrumentation for guided missile test cell



Production testing linear actuators

how WESTERN GEAR insures RELIABILITY



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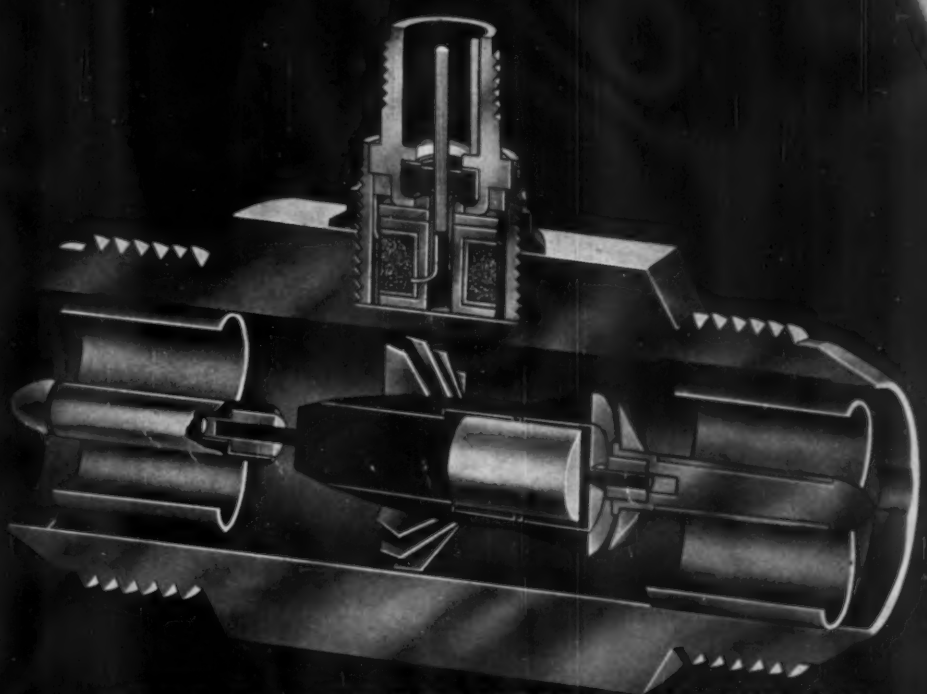

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FACTS about NEW DEPARTURE BALL BEARINGS

aircraft turbine bearings...

DESIGNED for HIGH SPEEDS, LOADS and TEMPERATURES

New Departure split inner ring bearing mounting for jet engine main shaft

Today's leading production jet engines turn on New Departure split inner ring bearings . . . an out-ahead development of New Departure's continuing Aircraft Research Program.

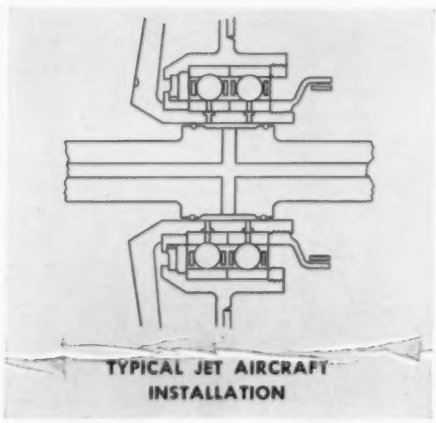
These turbine bearings handle heavy thrust loads from either direction and major radial loads with unexcelled dependability. Two-piece inner ring construction facilitates cleaning, inspection and assembly. It also permits use of the maximum number of balls of largest possible diameter with high thrust shoulders and one-piece separator construction.

While these bearings meet today's demand, tomorrow's needs command the facilities of the New Departure Aircraft Research Program. Already bearing development looks ahead to operational speeds in the order of 100,000 rpm and temperatures close to 1000° F. Write for New Departure's Aircraft Turbine Ball Bearing Folder TB-56. New Departure, Division of General Motors, Bristol, Connecticut.

MEDIUM and LARGE TURBINE BEARINGS

Basic Bearing No.	NOMINAL DIMENSIONS		
	Bore	O.D.	Width
LL34	6.6929	9.0551	1.102
LL36	7.0866	10.2362	1.614*
LL44	8.6614	12.5984	1.929*
L22	4.3307	7.0866	1.280*
L24	4.7244	7.4803	1.280*
L26	5.1181	7.8740	1.280*
L28	5.5118	8.6614	1.574*
L30	5.9055	8.5060	1.235*
L32	6.2992	9.4488	1.338
L34	6.6929	10.6299	1.815*
207	1.3780	2.8346	.669
209	1.7717	3.3465	.938*
212	2.3622	4.3307	.866
213	2.5591	4.7244	.905
214	2.7559	5.1181	1.023
215	2.9528	5.1181	1.181*
216	3.1496	5.5118	1.023
219	3.7402	6.6929	1.259
220	3.9353	7.0886	1.385*
222	4.3307	7.8740	1.771*
224	4.7244	8.4646	1.850*
228	5.5118	9.4488	2.007*
232	6.2992	10.1992	1.660
307	1.3780	3.1496	.826
315	2.9528	6.2992	1.456

*Puller groove, inner ring or both rings



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The most distinctive feature of Lockheed's Navy WV-2 Super Constellation, America's newest early warning plane, is the 30-foot disc-shaped radome rising above the plane.

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OCTOBER 22, 1956

AVIATION WEEK

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BUSINESS MANAGER.....J. G. Johnson
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RESEARCH AND MARKETING
Mary Whitney Fenton, Joan Read, Judith P. Wheeler

Manufacturers Face Military vs. Commercial Dilemma 28
► Air industry faces chronic dilemma of trying to produce aircraft with broad, combined commercial and military markets.

Winter Transatlantic Air Capacity Increases..... 39
► U. S. and foreign airlines offer 20% more transatlantic seats this winter season than last.

NACA's Mach 10 Rockets Aid ICBM..... 52
► Multi-Stage Mach 10 rockets of NACA help gain design data for intercontinental ballistic missiles.

Balloon Radar Antenna Is Major Defense Advance.. 94
► Radically different type of radar antenna inflated like a balloon; described as "major breakthrough for air defense."

MISSILE ENGINEERING
First Space Laboratory..... 31
Burke: Talos Scores Six Hits..... 31
Sidewinder in Operation..... 33
Radioplane Rocket Drone..... 35
Nike Powerplant Details..... 68

AERONAUTICAL ENGINEERING
Pilot Skill Gives X-2 Record..... 30
Baker Calls for Changes..... 31
First Douglas C-132 Details..... 35
SAE Tackles Jet Problems..... 55
Thompson Development Center..... 65
NATO Opens Aerodynamic Center..... 66
Bristol Shop at Mexico City..... 70
New Steel-Titanium Press..... 70
DC-8 Test Facilities..... 74
Bacteria Corrosion Jams Pump..... 74

AVIONICS
Precise Navigation Unit Developed... 103
Expansions in Avionics Industry..... 101
New Avionic Products..... 107

EQUIPMENT
CAA Cautions on Glass Fiber..... 32
Quota Ends on Turbine Minerals..... 33
Pilot-Steered Wheel Units..... 82
What's New..... 75
Off the Line..... 89

FINANCIAL
Stock Transactions..... 113
Certificates of Necessity..... 115

TRANSPORT
Airlift Needs Increase: Douglas..... 30
Air Force Jet Symposium..... 41
Braniff DC-7Cs Enter Service..... 41
CAA Emergency Exit Rules..... 42
Delta Revenue Increases..... 42
Overall Subsidies Drop..... 42
Data Gained With 'Paper' Transports 42
CAB Adopts Emigrant Fare Plan..... 43
Northwestern Opens Air Center..... 43
Preserver Rule Proposed by CAB..... 43
Flying Tiger Earnings..... 49
National Profit Rises..... 49
Western Declares Dividend..... 49
Shortlines..... 45
Airline Observer..... 47
Cockpit Viewpoint..... 49

SAFETY
Military Accident Rates Decline..... 31
IATA Urges Better Inspection..... 118

MANAGEMENT
Doolittle Leads NACA..... 31
Jet-Flap Technique on Transports.... 34
Who's Where..... 25
Industry Observer..... 25
Washington Roundup..... 27
Official Asks British Reappraisal..... 32
News Digest..... 36

Calendar..... 4
Letters..... 154

EDITORIAL
Are Air Shows Necessary?..... 23

COVER: Technological breakthrough in the design of tactical radar antennas has been scored by new "Paraballoon" type which can be inflated or deflated like a balloon. Developed by Westinghouse Electric Corp., new Paraballoon antenna greatly increases mobility and effectiveness of tactical air defense radars. Cover shows 50 ft. diameter antenna being adjusted to desired contour alongside completed 30-ft antenna. For additional details, see page 94.

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Member ABP and ABC

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EDITORIAL

Are Air Shows Necessary?

All of the major airpower nations in the world today find it desirable and necessary to stage air shows to demonstrate the quality of their aerial products both military and commercial. AVIATION WEEK has provided on-the-spot coverage regularly on the U. S. National Aircraft Show, the British S.B.A.C. flying display at Farnborough, and the biennial French air show in Paris. Last summer we added the Russian national aviation day display at Tushino airdrome outside Moscow to our long list of on-the-spot coverage. Based on the experience of our staff correspondents at these various air shows, we have a few random thoughts on their usefulness and proper place as an instrument of national air policy.

These major air shows are carefully tailored to meet specific national needs and thus vary greatly in content and purpose. Of the four, the U. S. show seems to be most lacking in clarity of purpose although during the past few years it has been assuming more and more the character of a spectacular annual report on military aviation to the U. S. taxpayers who provide the money to pay the national airpower bill.

Commercial Emphasis

This is a worthy goal but there is a growing sentiment in the aircraft industry that there should be more emphasis on the commercial aspects of aviation if the show is to retain its flavor as a truly national air show. It would appear that there is a much larger place for business and agricultural flying and air transport in the National Aircraft Show picture than was evident at either Oklahoma City this year or Philadelphia last year. There is little doubt that the policy of moving the show around the country rather than playing at a permanent annual stand is sound and should be continued.

It is equally evident that some serious thought should be given to eliminating or reducing the entrance fee charged the public or improving the facilities provided them for viewing the aerial display. It seems odd to charge the taxpayers for the privilege of viewing military airpower that they have already paid for with their tax dollars. If an entrance fee is continued, some substantial effort should be made to provide a better view of the show from temporary bleachers so that John Citizen gets some service for his money.

Russian Show Goals

The Russian air show at Tushino is perhaps the biggest drawing card of the quartet with close to 400,000 attending on a single day and staying long after the flying is finished to picnic on the grass airdrome and listen to the folk music of a dozen bands and choral groups. It is designed to convince both foreign observers and Russian citizens of the growing might of the Red Air Force. It is aimed at providing domestic assurance of air protection for Soviet and satellite peoples and warning to potential foreign enemies that they will have no easy task penetrating to Soviet targets.

Our judgment is that the Tushino display in recent years has been fairly successful in achieving these goals. It is also interesting to note that the Soviets have consistently used the Tushino show as the stage for revealing their new military and commercial aircraft even to the degree of flying advanced experimental prototypes.

The Society of British Aircraft Constructors annual flying display has become a mecca for technical, management and military people of international aviation. The business-social aspect of Farnborough has grown enormously in the past seven years as evidenced by the transition from a few trailers serving as hospitality centers to the long rows of blue and white tents that now house an astonishing variety of food and drink.

Another strong trend in the S.B.A.C. show has been the growth of the static exhibits of the equipment industry. They now overflow even the mammoth specially-designed tent originally built to adequately contain this mushroom growth. It is the increasing participation by the equipment industry that keeps Farnborough an annual show. The airframe and engine people who originally dominated the display would much prefer a biennial show allowing them time to put forth more new products. However, Farnborough will continue to be an annual show largely because the equipment makers who now make it such a profitable venture insist on this frequency.

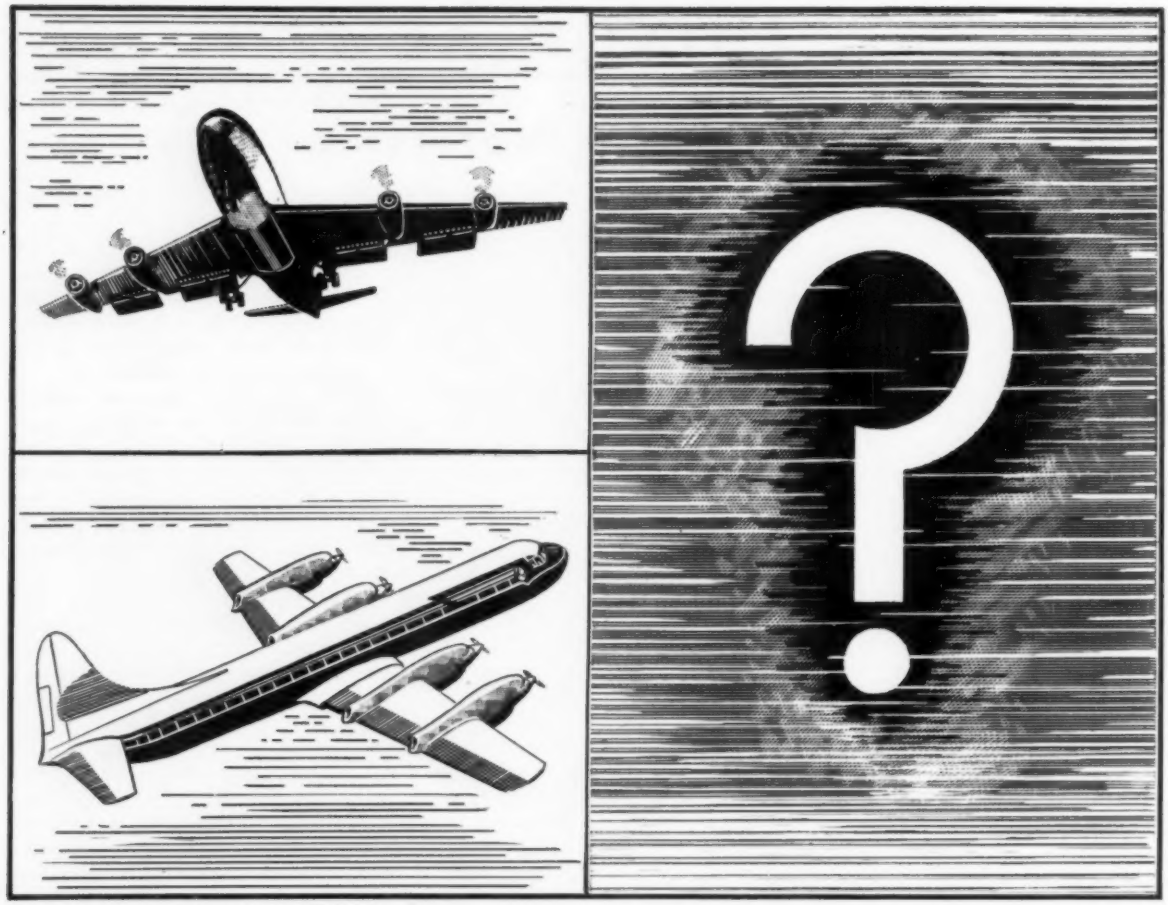
British Export Aim

The British show is aimed entirely at the export market and provides a broad and spectacular backdrop for the entire British aviation international sales effort for military and commercial equipment. It has certainly contributed to the steadily rising sale of post-war British aviation products abroad although the amount of time it saps from the technical pace of the industry has never been adequately assessed.

Beginning with the 1955 Paris air show the French event took on new vitality and significance. It is now one of the "must" ports of call for those who must keep abreast with international aviation. By staging it every two years, the French can produce sufficient novelty and variety to provide all of the zest of a new floor show at the Lido. The 1955 Paris show and the 1957 edition scheduled for next May should clearly establish the fact that this nation is again in the forefront of aeronautical development and a force to be reckoned with in military aviation and in the fierce commercial competition that is now characteristic of the international aviation market.

We think national air shows are vitally necessary to the health and growth of military and commercial airpower. However they must be carefully tailored to accomplish specific purposes and not carelessly thrown together to provide an aerial Roman holiday.

—Robert Hotz



Top: BOEING "707" Bottom: LOCKHEED "ELECTRA"

who'll be next to use PNEUMATICS?

The new Boeing "707" and the new Lockheed "Electra" are both equipped with Kidde compressor-powered pneumatic systems. The reliability of Kidde designed and manufactured equipment, proved by thousands of systems in military aircraft, made Kidde pneumatics a natural choice of these forward looking manufacturers. Who will be next?

Designers and developers of lightweight, dependable pneumatic actuating systems, Kidde's creative engineering staff has refined pneumatics to an amazingly flexible state. Today, there is no job—aloft or on the ground—which pneumatics cannot do as well *or better* than existing aircraft actuating systems.

In addition to 4cfm and 2cfm compressors which are currently in production, Kidde also has a complete line of allied pneumatic equipment—pressure relief valves, dehydration equipment, lightweight steel or fiberglass high-pressure storage vessels. 6cfm, 8cfm, 12cfm and 25cfm compressors, some developing 5000 psi, are now in various stages nearing production.

At this moment, Kidde can furnish many items of pneumatic equipment on an off-the-shelf basis, and can furnish as well the engineering talent to develop special equipment on request. Consider the use of pneumatics in today's, or tomorrow's, aircraft. Why not discuss your pneumatic problems with Kidde?

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In the Front Office

Rear Adm. Paul E. Pihl, board chairman, Hupp Aviation Co., Chicago, Ill.

Frank G. Hough, board chairman, Frank G. Hough Co., Libertyville, Ill. **G. A. Gilbertson** succeeds Mr. Hough as president and chief operating officer.

Maj. Gen. C. A. L. Dunphie, managing director, Vickers Limited, London.

Eric F. West, president, Aluminum Limited Sales, Inc., New York, N. Y. Mr. West succeeds **Ward Van Alstyne,** retired.

Grover Judy, vice president-general manager, Hycon Aerial Surveys, Inc., Pasadena, Calif. Mr. Judy succeeds **Duane O. Wood,** resigned.

Dr. B. M. Wolfframm, vice president, Magnetic Research Corp., El Segundo, Calif.

Cecil R. Russell, vice president-engineering and production, J. B. Rea Company, Inc., Santa Monica, Calif.

Walter R. Bush, vice president-engineering, Fenwal, Inc., Ashland, Mass. Mr. Bush also was appointed a Management Committee member.

Clifton J. Stratton, Jr., assistant general counsel, Air Transport Association, Washington, D. C.

Honors and Elections

The 43rd Bombardment Wing of Strategic Air Command received the U. S. Air Force Flight Safety Award honoring its record of more than 13,000 accident-free hours flown during the first half of 1956.

The International Civil Aviation Organization received the Christopher Columbus International Communications Prize (5 million lire) in Genoa, Italy in recognition of the accomplishments of ICAO in the field of international communication.

Herbert Kunzel, president of Solar Aircraft Co., was elected chairman of a newly organized San Diego chapter of the American Ordnance Association.

George E. Fouch, General Manager of the Evendale Operating Department at General Electric Company's jet engine plant (Cincinnati, Ohio), received the Navy's Distinguished Public Service Award. The citation reads in part: ". . . By giving freely of his time, talents and experience, knowledge of industrial programming has been expanded and refined. . . ."

Dr. R. M. Burns, senior scientific advisor to Stanford University Research Institute, was awarded the Acheson Medal of The Electrochemical Society for 1956 in recognition of his outstanding work on the corrosion of metals and his long-time participation and leadership in the society.

Changes

W. J. Jakimiuk, sales director, Sud-Est Aviation, Paris, France. M. Jakimiuk will be handling the Caravelle jet transport and Alouette jet helicopter.

Maj. Lewis W. Hieatt, officer-in-charge, Miami Air Force Procurement office, Miami International Airport, Miami, Fla.

INDUSTRY OBSERVER

► Navy will use the Pratt & Whitney J52 turbojet engine as a replacement for the Wright J65 in the Douglas A4D-3, a later version of the Skyhawk lightweight, carrier-based Navy bomber.

► **Ryan Aeronautical Co.'s first jet-powered VTOL, the X-13, is undergoing untethered vertical takeoff and landing tests at Edwards AFB, Calif. Transition flight phase for the aircraft is now being instituted. Second X-13 also is at Edwards.**

► Sled tests of new F-102 pilot ejection catapult at Edwards AFB, Calif., indicate that safe ground-level ejections can be accomplished through the combined use of a canted rocket and an old-style M3 piston. Combined thrust shoots pilot high enough into air for safe parachute landing. Talco is the manufacturer.

► **Minneapolis-Honeywell's first prime missile contract is for an Air Force air-to-ground vehicle. Contract was jointly awarded to the firm's aeronautical and ordnance divisions. Primary problem will be finding means of making missile peel back to target after its launch during mother plane's high-speed pass.**

► Top-level Air Force officers are interested in a VIP transport version of the Convair Model 880 jet transport that would offer nonstop Washington-Paris performance. This nonstop range would require more useful load devoted to fuel and less to passengers.

► **Republic Aviation Corp. has been awarded a $95,777,817 contract for modification of 484 F-84F aircraft as part of its program to retrofit the fighter with a simplified control actuator system (AW Sept. 17, p. 51).**

► Automatic transmission of weather observations from transatlantic aircraft is being pushed by the Weather Bureau to fill out the network of reporting points in an area now served only by a few weather ships and subjective pilot reports. Position information would be fed by automatic navigation unit, such as APN-66 or APN-82. Instrument package would measure temperature, humidity and, when over water, the D value (difference between pressure altitude and true altitude). Some airlines are evidencing interest. Estimates are that weight of the units would run as low as 30 lb.

► **North American Aviation, Inc., has received a $65,507,103 Air Force contract for continued research and development on the XSSM-64 Navaho intercontinental missile.**

► France's Dassault aircraft factory may construct a new production facility in Switzerland, probably in Geneva, for the construction of its Mystere fighter series. Outcome of discussions already under way depends upon Dassault's success in selling the Mystere to Switzerland.

► **Wright Aeronautical Division of Curtiss-Wright Corp. is continuing to push development work on its XLR-25 rocket engine which powered the Bell X-2 research plane (AW Oct. 1, p. 34). To carry out its rocket-engine studies, the division has established an Advanced Rocket Engine Division at Wood-Ridge, N. J.**

► Sikorsky S-58 established a helicopter point-to-point speed record on a delivery flight from Paris to Brussels. The Sabena S-58 covered the 185 miles in 1 hr., 16 min. for an average speed of 146 mph. Helicopter had been shipped from U. S. to France by sea.

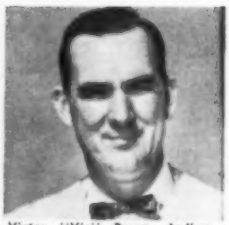
► **Belgium's SABCA aircraft factory has signed an agreement of cooperation with Fokker providing for the possible production of the turboprop Fokker Friendship transport in Belgium.**

Don Vest, Vest Aircraft & Finance Co., P. O. Box 5306, Sky Ranch Airport, Denver, Colorado.

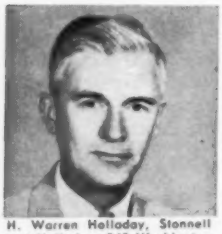
Gene Hudman, Stonnell and Holladay Aircraft Sales, Carolina Division, Municipal Airport, Charlotte, North Carolina

Peter Graves, Southern Ohio Aviation Sales Co., Dayton Municipal Airport, Vandalia, Ohio.

John Wilsdon, Hunter Aviation Co., P. O. Box 122, Lambert Field, St. Louis, Missouri.



Victor "Vic" Bruce, Indianapolis Executive Aircraft Corp., Indianapolis Municipal Airport, Indianapolis, Indiana.



H. Warren Holladay, Stonnell and Holladay, 843 Washington Building, Arlington Towers, Arlington, Virginia

Norman Hoffman, West Texas Flying Service, Midland Airport, Box 82, Midland, Texas.

Art Maurer, Arthur Maurer Co., Inc., LaGuardia Field, New York, N. Y.

John S. Brown, Brown Aero Corp. 3300 Love Field Drive, Dallas, Texas.

Robert F. Wood, Newport Air Park, Newport, Rhode Island.

Wynn Cronje Minnesota Airmotive, Inc., Minneapolis-St Paul International Airport Minneapolis Minnesota

A. M. "Sime" Bertolet, Reading Aviation Service, Inc., Municipal Airport, Reading, Pennsylvania.

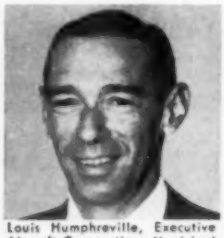
H. Leibee Wheeler, Buffalo Aeronautical Corporation, Buffalo Municipal Airport, Buffalo, New York.

Max R. Brand, Aero Commander Dist. (Downtown Airpark), Hangar 3, Municipal Airport, Tulsa, Oklahoma.

E. H. "Ted" Tolan, National Aero Sales Corp., Midway Airport, Chicago, Illinois.

W. D. Maddox, Aero Southern Corp., 601 North Broadway, Nashville, Tennessee.

W. H. "Bill" Buchanan, Sales Manager, Johnson Air Interests, Inc., Herlick-Racine Airport, Racine, Wisconsin.



Louis Humphreville, Executive Aircraft Corporation, Municipal Airport, Pontiac, Michigan.

W. B. Carrell, Chamberlain Aviation, Inc., Akron Municipal Airport, Akron, Ohio.

John A. "Jack" Bauman, Santa Monica Aviation, 3011 Airport Avenue, Municipal Airport, Santa Monica, California.

Herrol Bellamy, L. B. Smith Aircraft Corp., Miami International Airport, Miami, Florida.

Lucien M. Taillac, Trans-Aire Corporation, Pan-Air Building, New Orleans Airport, New Orleans, Louisiana

Joseph H. Frost, Jr.

Robert M. Brown

Commander Sales Company, Terminal Building, International Airport, San Antonio, Texas.

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Washington Roundup

No Satellite for Army

The Army will not launch a satellite—"accidental" or otherwise.

Despite published reports from several quarters, top Army research and development officials say emphatically that manpower, money and time of Army Ballistic Missile Agency personnel and others at Redstone Arsenal are committed to other projects, now and for the future.

Even Dr. Wernher von Braun, one of the first and most vocal advocates of satellites and one of Redstone's most influential scientists, scoffs at the idea.

Von Braun points out that "accidental" satellite launchings are impossible, and that a "sneak" launching would be suicidal so far as relations with Navy, Defense Department, Congress and the public go.

After President Eisenhower committed the U. S. to a satellite program—and in effect, to a race with Russia for the first launching—Defense asked all three services to propose programs.

The Army's was based upon existing hardware, stressed a quick launching to gain prestige over Russians, called for crude satellite, possibly even without instruments.

The Navy's program was more ambitious, calling for new hardware and a sophisticated satellite. Air Force plans were based upon the Atlas missile, which still has to be test fired.

Dr. von Braun insists that, when Navy got the nod, the Army dropped its satellite ideas and has not, and will not, suggest—formally or informally—that it be allowed to try to beat Navy into the sky.

Only possible way that the Army might enter the satellite picture, von Braun said, is for the Vanguard project to hit a serious snag. Then Defense officials might ask the Army to try to hang up some kind of hardware before the International Geophysical Year ends in December 1958, whether it had instrumentation or not.

Maj. Gen. A. P. O'Meara, Deputy Chief of Army Research and Development, points out that attempted launching now would take dollars and hardware away from existing programs. This will not happen, he said. Office of William H. Martin, Director of Research and Development, said the same.

Dr. von Braun, in fact, hopes the Vanguard program is successful, not only because Redstone has its hands full with other work but because it would represent "a greater breakthrough than our proposal would have."

Budget Wise Mr. Wilson

Citing the long lead time involved in most aircraft procurement, Defense Secretary Charles E. Wilson says USAF will not spend much of the additional $900 million provided by Congress during the current fiscal year. Instead, he indicated, the money will be used to help ease the budget burden for Fiscal 1958. The extra money, Wilson says, "is bound to have some effect on the new requested funds for 1958."

Where Time Is Lost

Action on the Aircraft Study Group's program to cut the weapon system cycle (AW Sept. 17, p. 26) will be delayed until after Jan. 1, when the military services are scheduled to come up with their programs. Meanwhile, Deputy Secretary of Defense Reuben B. Robertson, Jr., has called upon the Aircraft Industries Assn. to consider the recommendations and contribute what it can to the general objective.

Robertson is of the opinion, after studying the report, that from a third to a half of the time involved in getting a weapon over the road from concept to delivery is lost even before the formal requirements documents are written. The decisions at this stage, he admits, are delayed by poor communications, a lack of ready up-to-date data on technical feasibility, military significance, probable cost and other factors. He accepts the Study Group's thesis that the military services must improve execution of development and production programs.

Some AIA members, long unhappy with military requirement muddles, will applaud this discovery and hope for improvement. According to Robertson, major steps will include more full-time effort by qualified military officers, faster distribution of timely information and early support for the industry in the procurement of long lead time materials and components.

It also is clear that industry will get more technical data and get it quicker, that detailed specifications will be cut back, engineering change approvals will be speeded and facility requests expedited to ease the burden on industry.

Celler Hearings Through?

The House Anti-Monopoly Subcommittee headed by Rep. Emanuel Celler (D.-N. Y.) has abandoned plans for pre-election hearings on air transportation. It is even doubtful that the hearings will be held this year, and a report of findings and recommendations issued. The purpose of extensive hearings this spring, Celler said, were to determine whether monopoly was involved in the cases of Pan American World Airways, the Air Transport Assn., Air Coach Transport Assn. or the International Air Transport Assn. If the subcommittee's investigation is to continue next year, the full Judiciary Committee would have to vote a new authorization for it.

Army Intrenched in MAAG

A major USAF mission headed by Assistant Secretary Dudley C. Sharp and Maj. Gen. David H. Baker, Air Materiel Command Director of Procurement and Production, has returned from a round-the-world trip with some fresh observations about the Mutual Security Program. One striking fact: out of 34 Military Assistance Advisory Groups (MAAG), 21 are headed by Army officers, eight by the USAF. The United Kingdom and Spain are only key posts entrusted to USAF. Figures on rank: Army MAAG chiefs include 13 major generals, two brigadier generals. USAF stars are limited to two major generals, one brigadier general.

New Prominence for Harris

The death of Rep. Percy Priest (D.-Tenn.) makes Rep. Oren Harris (D.-Ark.) top ranking Democrat on the House Interstate and Foreign Commerce Committee which handles civil aviation matters. In the past Congress, Harris served as chairman of the Subcommittee on Transportation and Communications. His primary interest in aviation has been the development of the airways system. He favors rigid control of all commercial air movements.

—Washington staff

Conflicting Policies Hamper Design Effort

USAF policy discouraging the design of military planes to CAA specifications cuts civil market.

Washington—Army's struggle with the Air Force over aircraft procurement (AW Oct. 8, p. 26) points up a chronic dilemma faced by manufacturers when they try to produce aircraft with broad, combined commercial and military markets.

The Army is currently developing a campaign to reduce the Air Force role as a middleman in Army aircraft procurement. A keystone in the Army campaign is the insistence that its aircraft be designed to meet Civil Aeronautics Administration certification requirements as well as military specifications.

Air Force opposition to this philosophy illustrates the industry's problem when it is designing a military aircraft that has a major commercial application. Manufacturers would like to design these aircraft so they can pass both civil and military test, but, without complete Air Force acceptance of this design philosophy, the builders generally wind up designing for military specifications and giving up on the civil approach.

Money is a key to the situation. If the Air Force does not specify that a new aircraft be designed to meet CAA requirements, the manufacturer has to pay for extra CAA design work himself.

Along with this, the manufacturer rarely wants to compromise his design in any way to meet civil rules when it might jeopardize his chances of getting a more lucrative military contract.

Industry's Stand

This conflict in philosophy has a history of negotiation between the CAA and the Air Force and was studied by the Air Coordinating Committee three years ago when it was writing an overall government policy on aviation for the Eisenhower Administration.

The Civil Air Policy adopted by the President in 1954 recommended that all transport aircraft (fixed-wing and rotary-wing) except those designed for specific military missions, should be designed to meet the basic civil airworthiness standards.

The policy report pointed out that it has proved extremely costly to convert wartime transport aircraft to civil use, and that such costs can be avoided by using a single design standard for all transport aircraft.

Manufacturers feel that the Air Force has paid only lip service to this policy when it has bothered to pay any attention to it at all. They feel that designing a transport with both military and civil applications will broaden its market and result in lower prices for both customers.

Employing CAA requirements with military specifications on top of them would promote development of aircraft in civil fields the manufacturers cannot afford to enter solely on a commercial basis.

Helicopters and cargo aircraft are two categories where the industry can't afford heavy development programs because of limited markets. But, with substantial military contracts to support development of aircraft with common civil-military use, the industry could provide commercial operators with the more efficient machines they need but cannot obtain.

No Policy Without USAF

Generally, the aircraft manufacturers support the administration policy on joint design, and they feel it should either be fully implemented or disregarded, not retained as merely a paper regulation.

Industry experts point out that, without full Air Force cooperation, the policy cannot be implemented. While the Air Force does not object to a manufacturer including features based on the CAA rules in his design for a new airplane, these features are optional. Most manufacturers won't jeopardize their chances of winning a military contract by compromising their design with CAA features.

An example of this problem is the competition developing on the design of two-engine and four-engine turbojet utility transports for the Air Force. The USAF has invited bids on a light, twin-engine, four passenger utility trainer and a medium-weight, multi-engine, eight passenger utility transport.

New Air Force Policy

These two planes are being designed under a new Air Force policy that requires a privately-financed development program in which the manufacturer must have a prototype ready for testing before the Air Force will decide on the production contractor (AW Aug. 27, p. 29).

These two aircraft will have commercial application and, therefore, a commercial market.

In its invitation to bid, the USAF said it is "willing to consider design variations which may be necessary to qualify the designs for CAA certification."

Since the Air Force did not definitely specify that the designs be capable of CAA certification, companies interested in the competition must now make up their minds whether to design for both civil and military specification—and possibly compromise their chances of winning a military contract.

The Army is a strong supporter of the ACC policy recommendation. As its aviation program has grown, the Army has become more and more restive under the regulation that all aircraft must be procured through the Air Force.

Now, the Army is insisting that all of its aircraft with a major commercial application be capable of CAA certification. The service says it intends to buy aircraft the "quickest and cheapest way" and will by-pass the Air Force with direct purchases if USAF refuses to incorporate the CAA standards in contract requirements.

This stand could be a big help to helicopter operators. With military backing for design of helicopters to CAA standards, the operators would be able to get aircraft they can't pay for developing all by themselves. In turn, the Army wants to get as many helicopters into commercial use as possible to help improve the utilization and maintenance of rotary-wing aircraft.

Why USAF Opposes Policy

The Air Force is cold to the civil design philosophy, and staff officers have received no directive ordering them to implement the ACC policy. A CAA engineer serving as a reserve officer wrote a report recommending adherence to CAA standards while on active duty several months ago, and the recommendation reportedly "was not well received."

USAF spokesmen discount cost as a factor in their failure to require use of CAA standards. They say Air Force objections are based on technical considerations. For instance, military aircraft have to operate in extremes of heat, humidity and cold; stress standards frequently are higher than required by CAA, which has requirements based on minimum airworthiness, rather than optimum performance.

One USAF procurement official

This report on industry problems in attempting to design for both civil and military markets was compiled by Aviation Week Transport Editor Craig Lewis and Military Editor Claude Witze.

BOEING 707 prototype shown here on one of its rare appearances at a commercial airport, Seattle-Tacoma, is prime example of aircraft with joint commercial-military design approach. Boeing sold the design, which it developed with its own funds, to USAF as KC-135 jet tanker. Boeing has orders for 134 707s as commercial transports.

said: "We have no requirement for CAA certification and no intention of setting up such a requirement, but we certainly encourage the manufacturer to provide it on his own if he wants to and sees some commercial possibility."

Another factor is that USAF's military purchases have to follow the established standards of HIAD (Handbook of Information on Aircraft Design), and the handbook would have to be rewritten if procurement officers were to follow a new policy.

Closer USAF, CAA Liaison

Contributing to Air Force disapproval is the fact that the CAA depends to a great extent upon the integrity of the manufacturer, while the Air Force conducts its own testing for most aircraft. Also, aircraft components built to CAA standards may be procured from a limited number of suppliers, and the USAF wants to retain a degree of control over the supply base for quality control and mobilization purposes.

Some Air Force officials feel that continued conversations with the CAA are leading to greater understanding between the two, and that the two sets of standards are becoming more identical.

USAF's recent decision to ask manufacturers to develop new aircraft on their own for military-commercial sales is radical departure from usual practice. If it proves successful, Air Materiel Command may use the system to save money on development and promote design of military aircraft to CAA specifications at the same time. Right now, the main purpose is to save development money.

CAA Position

CAA says it has no axe to grind in the controversy. The agency feels it has a sound set of rules on which an airplane can be based and is willing to work with anyone who has an airplane to certificate.

The CAA does work with the military services on some aircraft when invited. Its participation in the military development cycle, however, is purely advisory and does not mean a certificate is issued when the military accepts the airplane. Such participation is designed to help find ways of meeting the Civil Air Regulations.

Commercial operators and the CAA have both had their troubles with putting military aircraft designs into civil operation.

The C-46 is a good example of a transport designed basically to military specifications. The CAA has had certification troubles with the transport since the end of World War II, and it still flies under special regulations.

Another example was the C-82 Packet. When the Air Force declared a number of these military-designed cargo carriers surplus, civil operators showed quick interest. Interest cooled somewhat when it was discovered that restrictions necessary to make the C-82 meet CAA standards were so steep, the airplane would be too expensive for commercial operation.

This surplus situation tempers the enthusiasm of some manufacturers for making military aircraft capable of certification. If the Air Force should declare a large number of such aircraft surplus and dump them on the market at some future date, the appearance of such cheap aircraft could ruin the market for some future commercial design.

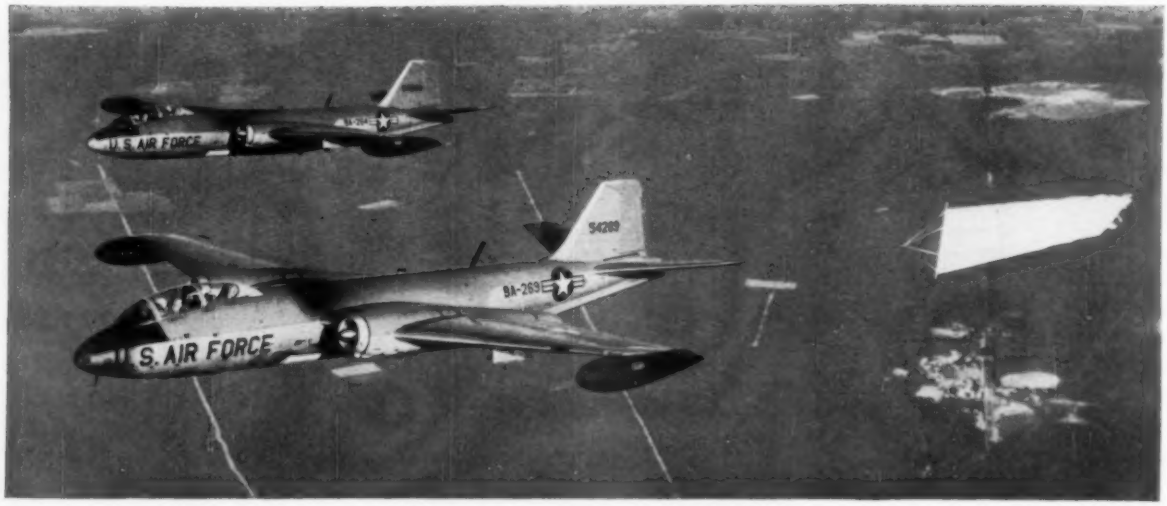
USAF's Air Materiel Command, which disposes of surplus aircraft from time to time, says it is a declared policy not to disrupt the market. Aircraft are offered for sale only in limited quantities and will be held back if there is any danger of upsetting commercial sales values.

Dual Role for 707

The Boeing 707 has developed as an aircraft which shows the benefits of the joint commercial-military design approach. Boeing has sold the design, which it developed with its own funds, to the Air Force and has contracts for the KC-135 jet tanker.

The same aircraft is the basis of the 707 series of commercial transports, and Boeing has airline orders for 134 of them. The 707 is currently going through the CAA certification process.

Lockheed's turboprop C-130 freighter could conceivably be the answer to the airlines' need for a true cargo transport. But Lockheed has not yet decided whether it will go to the expense of putting the C-130 through the CAA certification process.



New Tow Target Craft

USAF's new jet-powered tow target craft—Martin B-57Es—in use by 17th Tow Target Squadron at Vincent Air Force Base, Yuma, Ariz. First USAF airplane especially designed for target towing, B-57E nevertheless can be converted to a tactical bomber to augment Tactical Air Command strength in case of emergency. Powered by two Curtiss-Wright J65 engines, B-57E can tow a variety of targets and take four aloft in external containers. To convert to bomber, cockpit towing controls are replaced and internal cable reels and fittings removed from inside fuselage where they are normally carried on rotary type bomb door. External target containers also can be removed.

Pilot Skill, Engine Performance Give X-2 Record on Final Run

Washington—Capt. Milburn G. Apt's skillful handling of the Bell X-2 research plane and the exceptional performance of its rocket engine accounted for the record speed reached on its final flight on Sept. 27, the Air Force said last week.

The speed has been reported as above 2,100 mph., although the Air Force has not confirmed the figure.

Capt. Apt was killed and the X-2 destroyed at Edwards AFB shortly after he reported a successful powered run on his first flight (AW Oct. 1, p. 34).

The Air Force said that, in planning an optimum flight pattern for Capt. Apt's flight, emphasis was placed upon obtaining optimum attitude, normal acceleration and minimum use of controls, rather than upon speed.

After the drop from the B-50 mother ship, however, Capt. Apt handled the X-2 "so skillfully" that he achieved a nearly optimum flight path, the Air Force said.

This, plus better operation of the Curtiss-Wright XLR-25 engine than on any previous flight, resulted in the record speed.

The Air Force said other pilots have approached optimum operation with the X-2, only after several familiarization flights.

Lt. Col. Frank K. (Pete) Everest flew the X-2 five times before reaching 1,900 mph., and Capt. Iven Kincheloe, Jr., flew it three times before he took it to a record 126,000 ft.

What heating and stability and control problems Capt. Apt found at his record speed have not been revealed, although it is believed enough data has been recovered from the X-2's instrumentation to provide the Air Force with some of the answers.

The Air Force broke its relative silence after three weeks of refusing to answer most questions on the loss of the X-2. Although the final report of a board of inquiry had not reached the Pentagon by the time details of the last flight were revealed last week, preliminary reports have been in the hands of top Air Force officials for some time.

Air Force Secretary Donald A. Quarles said in a speech two weeks ago that Capt. Apt had flown faster than any other man (AW Oct. 15, p. 25).

Capt. Apt, 32, was a product of the Air Force Flight Test School at Edwards. He had made powered runs with the X-2 on the ground, served as panel operator in the mother ship on X-2 flights and had considerable time in the X-2 simulator.

He also had flown the chase plane on X-2 flights, including the recent flight on which Capt. Kincheloe reached his record altitude.

New Comanche

Lock Haven, Pa.—A new model of the four-place low-wing Comanche, powered by a 250-hp. Lycoming engine, will be added to Piper Aircraft Corp.'s business plane line in 1958. Price will be approximately $16,900. Prototype 1958 Comanche will fly next year. Deliveries of the Comanche with the 180-hp. Lycoming (AW June 11, p. 109) will begin next April. Price will be at about $13,500.

Douglas Says Airlift Needs Will Increase

Salt Lake City—USAF is capable of meeting its D-Day airlift requirements only by doubling the utilization of military transports and calling for the Civil Reserve Air Fleet of 350 four-engine aircraft, Air Force Undersecretary James H. Douglas told the National Defense Transportation Assn. here.

Douglas said that, if the Army requires airlift to move troops over long distances, the Air Force will be forced to use its heavy and medium troop carriers, the Military Air Transport Service and CRAF.

"There is no presently established requirement for substantially more airlift than is available," he said, "but it seems to me that pressures for increasing strategic or long-range airlift for ground forces are sure to increase."

Army Secretary Wilbur M. Brucker

recently said that he had been assured that airlift is available to move at least the newly reorganized 101st Airborne Division (AW Oct. 8, p. 79). It was clear at the time that Brucker's optimism was not shared by a number of his top military aides.

Douglas also noted the low priority given airlift within the Air Force. He said: "The competition for dollars between bombers and fighters and transports usually operates to postpone procurement of modern transports, but the Air Force is slowly acquiring thoroughly modern turboprop transports."

Douglas said present MATS four-engine transport utilization is slightly more than four hours a day (the figure fell as low as two hours shortly after World War II). He said MATS plans to increase its utilization rate.

Burke: Talos Scores Six Hits at 37 Mi.

New York—Talos anti-aircraft missile has scored six direct hits in succession on airborne targets at a range of 37 mi. during recent tests, Adm. Arleigh Burke, Chief of Naval Operations, told the Wings Club here last week. Among other new Navy developments revealed by Adm. Burke were:

- **Development of a seaplane** tender with a stern ramp capable of bringing the Martin P6M SeaMaster aboard for major repairs.
- **Development of submarine** refueling capabilities for special mission operations of the SeaMaster. Adm. Burke said that spray deflectors and jet engine shields have been developed for the SeaMaster that permit its operation in 6 to 8 ft. waves and wind conditions as high as 40 knots.
- **Development of an atomic** powered seaplane for the Navy is seriously hampered by lack of sufficient funds.
- **Navy air defense** radar now has practical range up to 300 mi. but experimental developments are being pushed to extend the Navy's early warning range considerably farther.

Doolittle Heads NACA

Washington—Lt. Gen. James H. Doolittle, USAF (ret.), has been elected chairman of the board of the National Advisory Committee for Aeronautics, succeeding Dr. J. C. Hunsaker.

Dr. Hunsaker, professor emeritus of aeronautical engineering at Massachusetts Institute of Technology and head of the MIT Aeronautical Engineering Department from 1933 to 1953, had served as NACA chairman since 1941. He will continue to serve as a member of the board.

Gen. Doolittle, a vice president of Shell Oil Co., is a special assistant to Gen. Nathan F. Twining, USAF chief of staff, and a member of the Air Force Scientific Advisory Board.

Military Air Accident, Fatality Rates Decline

Washington—U. S. military aircraft accident and fatality rates have declined from more than 40 to approximately 25 per 100,000 flying hours since 1950, according to statistics compiled by the Defense Department.

Without disclosing actual figures beyond a total of 7,600 killed in military aircraft since 1951, the Department made these observations:

- **USAF** rates tend to be lower than those of the other service because total flying hours include long flights in multi-engine planes.
- **Navy's higher rates reflect** the hazards of carrier-based flying in single-engine aircraft with a single pilot.
- **High Army rates result from** frequency of accidents in rotary-wing aircraft. For the Navy and Marine Corps, helicopter accident rates are equally high.
- **Although the probability** of a major accident has declined, those which do occur are increasing in severity. Thus, in 1930 only one accident out of 13 was fatal. In 1955, 2.6 out of 13 were fatal.
- **Flying accidents in 1955** cost more than $620 million in damaged or destroyed aircraft, up 20% from 1954. This is because planes are becoming more expensive.
- **Jet fighters and trainers** have a higher major accident rate than any other type aircraft, although these rates have declined for the past five years.
- **Predominant cause of accidents** is pilot error, accounting for 56.2% of all aircraft accidents. Materiel failure is blamed for 23.4% of the accidents.
- **About half the accidents** occur during landing.

Baker Calls for Radical Changes To Meet Tough Production Fight

Phoenix—USAF and the aircraft industry face "a long, tough production fight . . . . with no end in sight" and must plan now for radical changes to meet the challenge ahead, according to Maj. Gen. David H. Baker, Air Materiel Command Director of Procurement and Production.

Improved airplanes and missiles, Gen. Baker said, will press into higher speeds and altitudes than now considered possible, demanding at the same time more precise and reliable automatic controls.

Gen. Baker, in a speech before the National Industrial Conservation Conference, predicted these changes that will have a profound effect on USAF and the aircraft industry:

- **Rocket, ramjet and nuclear-power** plants will require new test and teardown facilities. Knowledgeable economists fear the country cannot bear the cost of the new heavy facilities.
- **Ground tests will require** new and more effective sound shielding.
- **Heat and strength problems** will require new types of materials both in structures and power plants.
- **New production techniques** must be developed to form these materials into dimensions, shapes and forms well beyond industry's present capacities.
- **Production methods** and equipment must utilize more automation to meet these demands with minimum waste and maximum accuracy.
- **Larger proportion of skilled workers** and technicians will be needed in the aircraft industry working force.
- **Shortage of professional scientists** and engineers will become more severe.

Gen. Baker also predicted that several successor types of manned, heavy long-range bombers will be needed beyond the life span of the Boeing B-52. Supersonic speed and intercontinental range will be essential, he said, as well as defensive armament against fighter, missile and radar opposition.

For reconnaissance, the General said manned vehicles will be needed with range, speed and altitude well beyond current models. Ultimately, these will be replaced by reconnaissance missiles.

First Space Lab

Nation's first space travel simulation laboratory, capable of evacuation to pressures encountered several hundred miles above the earth, is being built by Litton Industries, Beverly Hills, Calif., under USAF sponsorship to study space flight problems. Space laboratory will measure roughly 15 ft. in diameter by 25-30 ft. long, making it possible for human operators to perform tasks that might be required during space travel. Litton also has designed novel space suit, called a manipulator station.

Bristol Official Urges Complete Reappraisal of British Air Industry

London—Complete reappraisal of existing projects is "the only way to avoid permanent injury" to the British aircraft industry, according to F. R. Banks, a director of the Bristol Aeroplane Co. Ltd.

The Royal Air Force already ranks fourth behind America, Russia and Sweden in the quality of its equipment, Banks told the Royal Aeronautical Society last week. He blamed that state partly on the "inordinate time taken to issue an Air Ministry requirement" and partly on the industry, which was "not alive early enough to the implications of the new look in aircraft."

Look to U.S.

A good place to start the reappraisal, Banks said, is with a look at the American industry with an eye towards adaptation and modification of its techniques for British use.

Banks' views, coming on the heels of glowing press reports from Farnborough that all was well with Britain in the air, added weight to earlier thoughtful reviews of the British aeronautical scene.

"We should take the realistic view that it would be unrealistic to attempt to compete with America in the scope, variety and size of their various projects," Banks said. Instead, he recommended concentration on smaller or moderate-sized civil transports—up to 150,000 lb. gross weight—and meeting the needs of the specialist operator. For military development, he suggested the supersonic bomber and the ICBM, even if only one design of each could be developed. All-out competition with Russia and the United States in engine quality and performance also was urged.

Consolation Prizes

As part of the industry's reappraisal, Banks suggested the weapons system approach for both the design teams in industry and the requirements teams in the Air Ministry. To assess the proposed designs, Banks recommended the creation of a weapons evaluation team in the Ministry of Supply, the contracting agency for all British aircraft and aircraft engine research and development.

In opposition to some British views, Banks did not advocate elimination of MOS.

Selective awards of contracts, based on weapon evaluation, was suggested by Banks; he added that "consolation prizes, in the form of prototype and limited production orders" should be avoided.

Assessment of new weapons should be based also on the capability of a firm to design, develop and produce aircraft at a desired rate, Banks said.

Requirements handling in the Air Ministry has been handicapped by two factors: lack of a high degree of technical knowledge on the part of some of the officers appointed to the jobs, and the lack of continuity in office. Banks said there should be a corps of engineering officers of the highest technical qualifications and with these personnel there could perhaps be formed the British equivalent of USAF's Air Materiel Command.

Viewing the transport side, Banks said that the British must organize larger technical and production units or give up the idea of meeting competition from the United States and Russia. A realistic figure for profitable manufacture would be about ten large aircraft per month, he said; this calls for much larger production units if it is to be considered at all.

Engine Assets

"In the engine industry, we have the greatest asset and contribution to our strength and prosperity in aviation," Banks said, "and all this could vanish almost overnight and the industry as a whole be made bankrupt by any false moves, made in the name of national economy, to reduce the scale of effort—which is already being jeopardized by a slow-moving aircraft situation."

Banks pointed out that Britain still has to formulate an advanced and logical program of research and development in line with leading countries.

"The lesson we should have learned . . . is that aviation has grown into big business and serious business, and that it cannot be run by a few people with ideas. It needs considerable foresight, first-class organization and elaborate facilities to get anywhere at all."

Francis Rodwell Banks

Air Commodore Francis Rodwell Banks has a long engineering career associated with powerplant development in private industry, the Royal Air Force and the Ministry of Supply. During World War II, he was Director-General of Engine Production and later Director of Aero Engine Research and Development, seconded from the RAF Volunteer Reserve to the Ministry of Aircraft Production. After returning to the Associated Ethyl Co. in 1946, he was loaned by the firm to the Ministry of Supply in 1952 to be Principal Director of Engine Research and Development. He was named to a directorship of the Bristol Aeroplane Co., Ltd., in Oct. 1954.

CAA Cautions Use of Glass Fiber

Washington—Civil Aeronautics Administration today sounded a note of caution in the use of glass fiber cloth for recovering small aircraft.

CAA safety agents warned that glass cloth is not the "miracle material" aircraft owners had hoped for and said improper application of the cloth can be a "short cut to a ruined airplane." They agreed, however, that glass fiber is more durable and at least as strong as doped cotton fabric.

Difficulty in getting a taut covering and in securely fastening the material to the aircraft frame are the chief problems confronting glass cloth advocates, the CAA said. No material is now known, they added, that will shrink the fiber glass cloth tightly into place as dope shrinks cotton.

The CAA said air pressures will cause ballooning of the cloth if it is loose, destroying airfoil and inviting rips. While glass cloth impregnated with resin does not tear easily, rips spread rapidly once started.

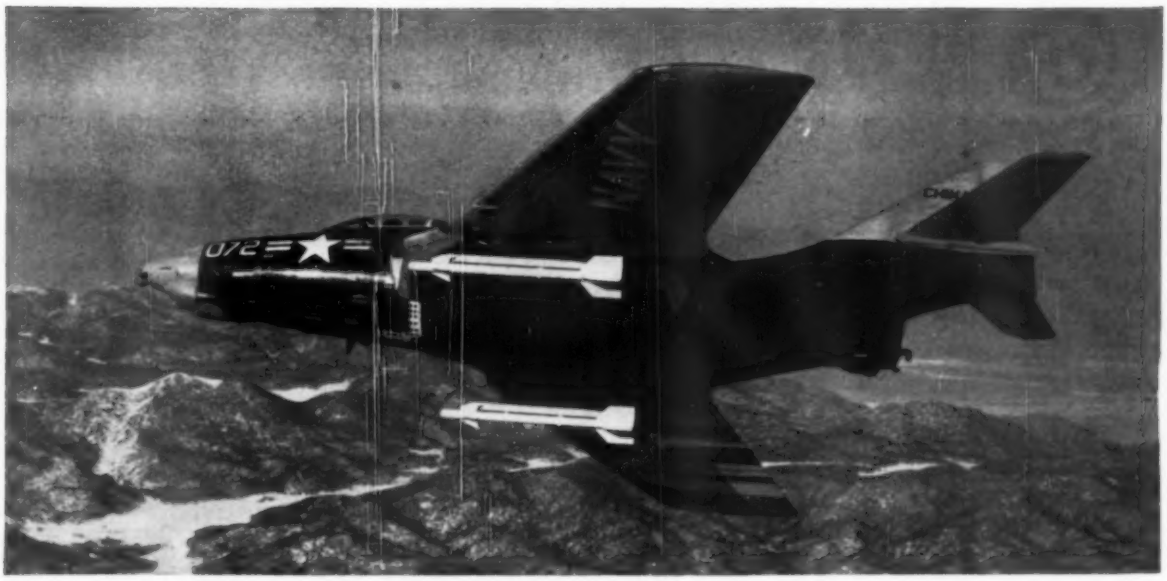
In addition to this, resistance to chafing is not a characteristic of glass cloth.

For some time, airplane owners have been seeking a substitute covering for cotton, because the fabric normally deteriorates rapidly, creating an expensive recovering job every few years.

Glass cloth once appeared to be the answer, and the CAA will approve a glass cloth replacement covering providing it meets strength and tautness requirements. However, CAA considers this a major alteration requiring engineering evaluation by safety agents.

Some attempts have been made to solve the problem of tautness by applying the glass cloth over existing cotton covering, using the basic fabric as a mold. CAA will approve this modification only if the underlying fabric retains the same strength that would be required if there were no covering over it.

The CAA also will consider the airplane as airworthy until the underlying fabric has lost half its original strength if the glass cloth is fastened independently to the underlying structure.



Sidewinder in Operation

Blunt-nosed Sidewinder, Navy's new air-to-air guided missile, is now operational with Attack Squadron 46 aboard the USS Randolph with the Sixth Fleet in the Mediterranean and Fighter Squadron 211 aboard the USS Bon Homme Richard with the Seventh Fleet in Western Pacific. Navy says missile, about 9 ft. tall with fins at nose and tail, has few moving parts and no more electronic components than an ordinary radio. Sidewinder is basically defensive, can destroy enemy fighters or bombers from sea level to altitudes over 50,000 ft. Sidewinder, evolved by Dr. W. B. McLean, now technical director of Naval Ordnance Test Station, China Lake, Calif., is produced by Philco Corporation's Government Industrial Division, Philadelphia.

Defense Abandons Turbine Metal Quotas

Washington—Quota system controls over consumption of cobalt, nickel, chromium, columbium, molybdenum and tungsten in the manufacture of gas turbine engines have been abolished.

In place of the controls, the Defense Department now requires the Army, Navy and Air Force to report annually how much of the six materials has been used for production and development of each gas turbine engine model. The reports must be submitted to Frank D. Newbury, Assistant Secretary of Defense (Engineering).

Purpose of the new system, according to Newbury, is to provide a warning in case the supply of the materials goes below the level considered essential for mobilization purposes.

Newbury emphasized that the new system does not ease the pressure on the services and their contractors to exercise conservation of the six metals. It does mean, however, that reserves are now considered adequate for mobilization purposes in view of the demand for engines under development or in production.

Newbury said quotas will not be used again unless there is threat of a shortage. The new Instruction replaces one issued in July, 1955.

Jet-Flap Research May Hold Key To Transport Runway Problems

By Evert Clark

Langley AFB, Va.—Work under way at the National Advisory Committee for Aeronautics' Langley Laboratory indicates that jet-augmented flap may be applied to jet airliners sooner than expected.

On the military side, research also indicates that "tail-sitting" is the only practical method of vertical takeoff for high-performance aircraft. The "tail-sitting" principle has been tested in propeller driven aircraft and is now being tested with jets, both in dynamic models here and in the Ryan X-13.

Although more pressing problems are getting greater attention here, researchers are optimistic about the use of jet flap for transports—primarily because of a new technique they stumbled upon in trying to test an earlier technique.

At least some of the designers of the upcoming generation of jet transports have known the results of NACA's preliminary studies since early last summer.

Dynamic testing of this new technique, described briefly in the Oct. 15 issue of AVIATION WEEK (p. 27), will begin soon with a scale model resembling the Boeing 707.

How Jet Flap Works

Early analytical studies indicated that use of the NACA principle on a jet transport with a 300,000 lb. takeoff weight and a 3,000 sq. ft. wing area would cut takeoff runs from 8,500 ft. to 4,500 ft., and takeoff speed from 150 to 115 mph. With a 200,000 lb. landing weight, landing distance would be cut from 7,000 to 3,700 ft. and speed from 115 to 80 mph. Thrust in these studies was figured at 66,000 lb.

Greatest advantages of NACA's technique—deflecting the exhaust from the podded engine upwards and spanwise over a small-chord flap at the wing's trailing edge—are relative simplicity, safety and the ease with which it could be incorporated into designs now on the drawing boards.

The dynamic model, which will test the principle, is 6 or 7 ft. long and in configuration is generally similar to the Boeing 707, except that it has two pairs of double podded engines rather than the 707's four in individual pods.

NACA described it as a 1/20th scale model of a 300,000 lb. transport, which would make the length of a full-scale aircraft of this design between 120 ft. and 140 ft. (The Boeing 707-320 will be 140 ft. long, weigh more than 280,000 lb. fully loaded and have engines of greater thrust than the 10,000 lb. J-57 planned for the first 707s.)

The model, powered by a hydrogen peroxide rocket motor, will be tested in the full-scale wind tunnel and in two dynamic facilities (AW Oct. 15, p. 28) which together allow testing of control and stability as well as lift.

Jet exhaust will be simulated with "cold jets"—in this case with compressed air.

'Accidental' Discovery

NACA discovered the technique it is now testing while attempting to explore a method tried earlier by the British—using small jet engines inside the wing to produce a flow through a narrow full-span slot at the trailing edge.

When NACA researchers considered building a small model, they realized the slot at the rear of the wing would have to be .002 to .003 in. The difficulty of building such a model led to the suggestion that the exhaust be piped out the bottom of the wing and

Various Hawker Hunters

Five variations of the Hawker Hunter being flown by the Hawker test pilot aerobatic team. In the formation are the two-seater Hunter T.7, leading; Mark 4 armed with Fireflash guided missiles, right of leader; Mark 6 with streamlined wing tip tanks for long-range high altitude interception, left of leader; Mark 6 with four 100-gallon drop tanks for long range patrol, next to last, and Hunter 6 ground attack version, rear, with two long-range tanks and 24 rocket projectiles. Hunters with underwing stores have standard attachment pylons so they can change combat roles.

First Douglas C-132 Details

Los Angeles—Douglas C-132 turboprop transport designed for Mach 0.8 cruise and top speed above Mach 0.9 will gross more than 500,000 lb. Normal payload is 100,000 lb.; with an overload payload of 200,000 lb., it will be able to fly 3,500 mi.

The high wing is sharply sweptback and has a high aspect ratio. The deep fuselage has a straight upper line and belly line that breaks sharply upward toward the tail starting at about two-thirds of the distance aft. Nose is similar to the Boeing B-52. Fuselage cross-section is a "double-bubble" type. Tail surfaces are swept and a dorsal fin is used.

Powerplant of the C-132 will be four Pratt & Whitney Aircraft T57 turboprop engines rated at 15,000 eshp. each.

Main landing gear will have 16 wheels to keep footprint pressures down to current levels.

Details of the design were shown on a projected slide at a USAF briefing for the Los Angeles World Affairs Council.

turned rearward by means of a number of small L-shaped tubes.

Flow from the tubes was to be directed downward by a flap. The makeshift arrangement led, in turn, to the idea that the flow from podded engines—safer and more popular with the transport-riding public than buried powerplants—could be used.

The NACA said the exhaust flow will spread spanwise, once when it hits a deflector at the tailpipe of the engine, and again when it hits the flap, giving "a surprisingly large increase in lift."

In addition to lift, the NACA technique probably would have these advantages:

• **Cut landing-gear weight,** if it is found that jet augmentation can be used on all takeoffs and all landings.

• **Eliminate need for thrust reversing.** Most thrust reversers studied so far would add significantly to weight problems and possibly affect stability.

• **Cut down engine noise,** one of the major problems of the jet transport age. If diverting some of the engine exhaust does not lessen noise directly, it should at least contribute by helping aircraft get off and climb more quickly.

Disadvantages may include:

Possible Disadvantages

• **Some weight penalty.** In addition to the small amount of weight added by deflectors at the tailpipe, wings and flaps may need some strengthening to take care of heat and structural stresses. NACA's early studies did not take into account this penalty—at least partly because it might be offset by lighter landing gear.

• **Use of deflectors** on all four engines of a four-jet transport might introduce stability and control problems. If so, deflectors could be used only on inboard engines—giving less augmentation but also avoiding stability problems and increasing safety by leaving two engines free to provide only forward thrust and outboard stability.

Since jet augmentation's greatest value would be to solve the problem of longer and longer runways, even partial application would be worthwhile. One NACA spokesman said cutting runway lengths from 8,000-9,000 ft. to approximately 7,000 "would be a tremendous advantage."

Use on inboard engines only would eliminate the need for a large tail to provide balance, and would require less beefing up of the wing.

The augmentation of lift is most useful directly under the center of gravity, or as close to it as possible. Use of double-podded engines slightly inboard of center of the wing—as in the NACA dynamic model—might provide a way to use all four engines for extra lift and still maintain stability.

The NACA technique could be applied to podded engine military aircraft such as the B-52, B-47 and KC-135, as well as to transports.

For use with smaller military aircraft, specifically a light reconnaissance or observation plane, the NACA is investigating use of a deflector consisting of a cascade of vanes located under the fuselage at a point below the wings.

The deflector, located flush with the fuselage during flight, would be angled downward into the exhaust flow from a single jet engine for landing and takeoff, giving an almost vertical lift. This is now being tested with a dynamic model approximately 6-ft. long.

Because the engine must be short enough for the exhaust to leave the engine about mid-way back on the fuselage, cascades could not be used with high-performance fighters and interceptors.

Convair to Simulate 100,000-Ft. Altitudes

Environmental test chambers to simulate altitude up to 100,000 ft. and temperatures from −100F to plus 500F will be constructed at the Ft. Worth, Tex., plant of Convair Division, General Dynamics Corp. Work on the $2 million facility is to begin this month.

The new facility will have both equipment and test buildings, and the test building will house three test cells of varied size, an instrument corridor and a control room. The equipment building will house compressors, refrigeration equipment, heat exchangers and other auxiliary equipment to supply the test chambers.

Walls of the buildings will be reinforced steel plate with 12-in. thick insulation wall lining. Completion is expected during 1957.

New Rocket Drone

Radioplane Co. of Van Nuys, Calif. developed new rocket powered target drone, RP-70, designed for weapon system evaluation and training at Mach 0.9 and 50,000 ft. Vehicle is powered by a solid propellant rocket with 8 to 10 min. flight endurance. Air frame, weighing 300 lb., is over 9 ft. long with wing span of 5 ft. Midsection of fuselage is steel rocket motor case, but other primary structures are made of glass fiber and reinforced plastic. Plastic wings, horizontal and vertical stabilizers, are fixed. Drone is controlled by small canard vanes forward of the wing, linked directly to flight control system. RP-70 is ready for flight test. Radioplane, subsidiary of Northrop Aircraft, Inc., is engaged in research and development of guided missiles for USAF.

News Digest

Douglas Aircraft Co. backlog of commercial orders amounted to half the company total orders for the first time in its history in nine-month period ended Sept. 30. Backlog total was $2,279,842,000. Third quarter net earnings were $20.5 million, equal to $5.56 a common share, on sales of $711,285,995. For the same 1955 period earnings were $23.3 million, or $6.31 a share, on sales of $679,157,313.

Japan's first practical supersonic wind tunnel was tested successfully at Tokyo University's Scientific and Engineering Institute. Continuous running tunnel, for fundamental research on boundary layer and turbulence, has a 450 hp. engine capable of generating speeds from Mach 1.5 to Mach 3.

First Canadian-built Grumman CS2F Tracker was delivered to Royal Canadian Navy by de Havilland Aircraft of Canada, Ltd. Plane will go aboard the new Canadian carrier Bonaventure, scheduled for commissioning in January.

Sperry Rand Corp. facility at Phoenix will be called Sperry Phoenix Company, Division of Sperry Rand. Construction of $2-million plant on 480-acre tract will begin soon.

Squadron of 16 North American F-100 Super Sabres completed 4 hr. 55 min. nonstop Atlantic Ocean crossing. One aerial refueling was made in deployment of planes of 450th Fighter Day Wing at Foster AFB, Tex., to Landstuhl, Germany, via Sidi Slimane, French Morocco. Average speed was 578 mph.

Convair 440 deliveries are levelling off at eight a month. October deliveries include three for Sabena Belgian World Airlines, two for National Airlines.

Royal Air Force will base two Vickers Valiants and two English Electric Canberras with Canadian Experimental and Proving Establishment detachment this winter at Namao, Canada. Purpose is to give crews experience in continental flying in winter conditions.

Safety awards for accident-free man hours were given to Republic Aviation Corp., and Curtiss-Wright Corp. by Liberty Mutual Insurance Co., which is an industrial employe insuring company.

French aircraft industry backlog of foreign orders stands at 150 aircraft worth $90 million. Orders amounting to approximately $30 million are now under discussion.

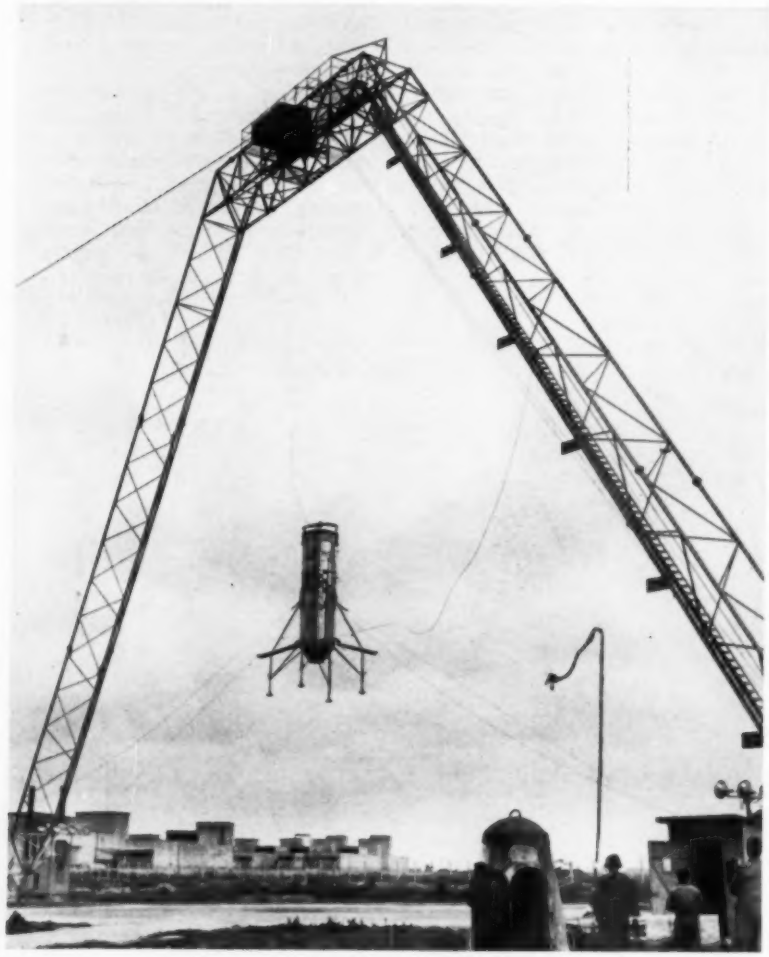
Temco Aircraft Corp.'s Greenville, Tex., plant was awarded a half-million dollar contract for extension of previously ordered services and parts for TB-29 aircraft.

Convair Division awarded Rheem Manufacturing Co. add-on contract of $2,667,000 for aircraft control surface parts for Convair F-102A. Production will be at Rheem's Government Products Division, Downey, Calif.

Southwest Research Institute's new $625,000 facility at San Antonio for hydrocarbon radiation research for Pratt & Whitney is to be completed before end of year. Research is in connection with P&W's nuclear aircraft propulsion program.

CAB assigned investigation team to ditching of Pan American Boeing Stratocruiser last week 1,150 mi. out in Pacific beside Coast Guard Cutter Pontchartrain. All 31 persons aboard were saved by cutter. Plane, which lost two engines, remained afloat approximately 20 minutes despite being split in half on contact.

Receipt of a $50 million re-order from Navy for WV-2 Super Constellation radar planes increased total military contracts awarded Lockheed Aircraft's California Division in the past three weeks to nearly $140 million. The WV-2 order, the fifth placed by the Navy, will extend deliveries of the radar planes through 1958.



Snecma's Flying Turbojet

First inflight photo of Snecma's Flying Atar shows wingless aircraft operating under a 115-ft. gantry. Unit includes an Atar turbojet engine of 6,200 lb. thrust, fuel tanks and control equipment, weighs 5,600 lb., including fuel. It can take off either vertically or laterally, with jet blast deflection used to alter direction. Unit is controlled remotely by pilot from radio shack. Cables are for safety, company says, and do not assist aircraft.

NEW from EEMCO

A 400 Cycle AC Linear Actuator

with an operating range of

320 to 480 cycles

SPECIFICATIONS FOR TYPE D-818

Normal operating load: 6000 pounds
Maximum operating load: 12,000 pounds
Ultimate static load: 24,000 pounds
Stroke: 3.15 inches
Rate of travel: .33 inches per second
Amperes: 3 amps. at 480 cycles on 200 volts at the 6000 lb. load
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Qualification: Type D-818 has been designed and qualified to meet applicable military and aircraft manufacturers' specifications.

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TRAIL BLAZING—Many frontiers of science have been charted by Northrop Aircraft engineers and scientists in seventeen years of research and development of manned and pilotless aircraft. Northrop Snark SM-62s, first intercontinental guided missiles to be disclosed by the U. S. Air Force, are now flying from the Florida coast over the USAF missile test range. Northrop's newest trail blazer is a supersonic trainer designed to help pilots master the complexities of tomorrow's combat aircraft. Other Northrop trail blazers include Scorpion F-89 interceptors; pilotless target aircraft and missiles from Northrop's subsidiary, Radioplane Company; ground support and armament equipment from the Anaheim Division; and, entirely new concepts of integrated weapon systems which are constantly being initiated to improve our national defense.

NORTHROP

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Winter Transatlantic Air Capacity Hiked

By Glenn Garrison

New York—United States and foreign-flag airlines will offer about 21% more transatlantic seats this winter season than during the 1955-56 winter period, an AVIATION WEEK survey discloses. While total capacity will vary as some schedules are altered during the season, the scheduled carriers will produce an average of some 10,500 seats a week from North America to Europe.

Many of the seats will be in brand new equipment, and more of them will be in combination-class aircraft than last winter. About 178 flights weekly in each direction will be offered by the carriers, compared with a weekly average last season of about 153 flights.

Wide use is being made of the 15-day excursion fare established last June by International Air Transport Assn. Airlines are adapting existing package tours to the time limit, setting up new packages within the excursion framework, and offering "do-it-yourself" plans to travelers who want to work out their own low-fare itineraries.

Notable newcomer to the transatlantic winter airlanes is the Douglas DC-7C, already in use by two of the carriers and scheduled for service by two others before the season is out. Other airlines have put new Constellation Super G equipment on the run. The 1649A Constellation, on order by two other carriers, won't make its first appearance until next spring. Familiar DC-6s and DC-6Bs, Super Constellations, Stratocruisers, DC-4s and a tourist-cargo DC-6A will provide the rest of the winter production.

Combination Flights

Increase of only 16% in number of weekly flights, while seats are up 21%, results from the fact that almost all the additional flights are combination, with a reduction in all-first-class flights, following the trend in that direction. Last winter, the airlines averaged 42 first-class, 32 all-tourist and 79 mixed flights weekly. This winter, the split will be 33 first-class, 35 all-tourist, and 110 mixed flights per week in each direction.

Outstanding exception to this development is KLM Royal Dutch Airlines. Last year KLM flew three combination schedules a week, plus four each of all-tourist and first-class. This winter, the Dutch carrier has taken off all its mixed flights and offers seven all-tourist and seven first-class weekly.

The airline says the change was made possible by the additional frequencies, amounting to daily service for each class of traveler. Handling only one class of passenger makes things easier for the crew and better for the first-class customers than mixing types of service, according to KLM. The airline's route structure, of course, is favorable to this kind of transatlantic scheduling.

KLM's transatlantic equipment, all Super Gs this winter, carries 37 in first-class, 79 in tourist configuration. DC-7Cs are due next summer.

Mixed Arrangement

The American carriers, on the other hand, have shifted strongly toward the mixed arrangement. Pan American World Airways offers 49 weekly flights this winter, up six flights from last season. Of this winter's total, 28 are mixed, 14 first-class, and seven all-tourist. Last winter the flights were 20 mixed, 16 first-class and seven all-tourist. This year's capacity will average about 3,026 seats weekly each way, up from 2,677 last winter.

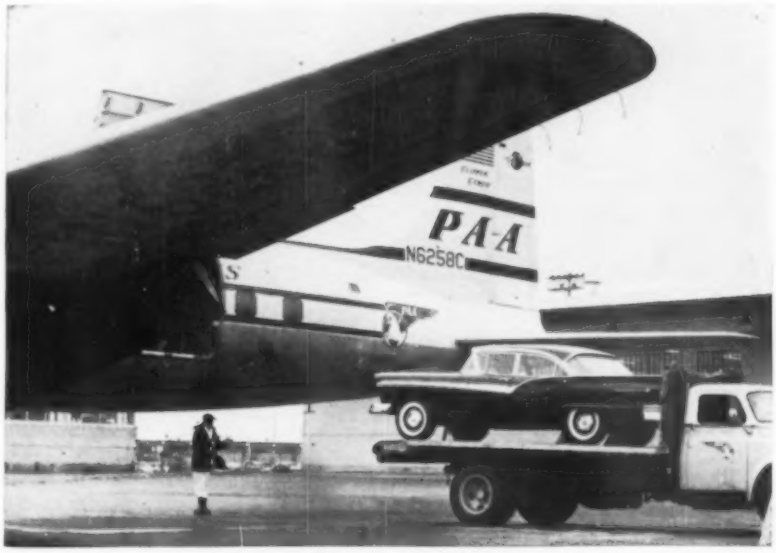
Pan American uses Stratocruisers for its first-class service, seating 43 passengers; and DC-7Cs, DC-7Bs and DC-6Bs for its dual and tourist flights, the dual configuration varying on different flights and the all-tourist version seating 72.

Trans World Airlines flights will average about 31 each way per week during the winter, split 13 mixed, three first-class, and 15 tourist. Last winter TWA flew five mixed, 11 first-class, and 16 tourist schedules. Carrying 45 passengers in combination for most flights, 30 on first-class, and 59 on all-tourist, the airline will produce about 1,560 weekly seats in its Constellations and Super G Constellations this winter. This is a 2.2% increase over last winter's capacity, number of weekly flights is one less than in 1955-56.

TWA has shifted more heavily to mixed schedules because of the additional frequency possible for each type of traveler and for the higher overall load factor the combination configuration produces on its overseas routes. The airline expects to operate Constellation 1649A equipment on the run sometime next spring.

Remainder of the North Atlantic scheduled airline picture for this winter:

• **Air France** expects to offer 17 flights, all mixed, up seven from last year's, which also were all mixed. The carrier's Super Gs normally will provide 34 tourist seats, 20 lounge seats, four berths (eight passengers). Two of the schedules still tentative at this point



Ford Flies to Moscow

Ford 1957 model sedan about to be loaded aboard Pan American World Airways Clipper at New York International Airport. Auto turned up on streets of Moscow on Oct. 1, two days before new model unveiling in New York. It was consigned to U. S. Embassy, unloaded at Helsinki, boxed and placed on Russian rail car for Moscow.

FIRST 1649A Constellation taking off from Lockheed Air Terminal and in flight on maiden hop. Flight was first test of new 150-ft. wing, 27 ft. greater than previous Super Constellations. Aircraft is in production at Lockheed for Trans World Airlines and will go into service next spring and summer on the transatlantic as well as domestic flights.

are among seven through flights, all new this winter, to Middle East destinations. Two of Air France's weekly flights will continue to depart from Chicago via Canada to Paris.

The carrier has 1649As on order, expects first deliveries in June.

• **British Overseas Airways Corporation** will offer 17 flights a week, nine combination and eight first-class. Stratocruisers will handle all flights until around the middle of January, when DC-7Cs will be phased into some first-class schedules. The mixed Boeing flights will carry 50 tourist and 17 first-class passengers, first-class Stratocruisers will accommodate 50 passengers. The DC-7Cs will carry 48 passengers first-class.

BOAC last year dropped its Chicago service for the winter; this season will retain one weekly Chicago departure, a combination flight. Five of BOAC's weekly flights will depart from Montreal, one of them first-class.

• **El Al Israel** will, as last winter, fly its two 64-passenger Constellations, both in tourist configuration. The airline hopes to get first of its Bristol Britannias by next October.

• **Iberia** schedules will remain until early 1957 at two flights, both of them mixed Super Constellation configurations carrying 71 passengers. Delivery of Super Gs next year will permit a schedule increase.

• **Linee Aeree Italiane's** flights have increased from three to four for the winter, all of them mixed.

LAI's DC-6Bs carry 57 tourist and 16 first-class passengers; its DC-6s carry 40 and 14, respectively.

• **Loftleider Icelandic Airlines** will offer four 52-passenger DC-4 tourist flights at off season rates lower than the IATA excursion fares. Last winter Loftleider flew three winter schedules.

• **Lufthansa** North Atlantic schedules are up from four last winter to eight, all of them mixed and two of them from Chicago. The West German

carrier's equipment is Super Gs, accommodating 16 first-class and 49 tourist passengers, on the average. Lufthansa's domestic connecting services have been expanded to serve 10 major terminals compared with two last year.

• **Scandinavian Airlines System** offers the same total of 11 weekly flights as last winter, but seats have gone from 563 to 628 per week, an 11% increase. All flights are mixed, whereas last winter SAS flew two first-class schedules. The airline is using new DC-7Cs for seven of the flights, with 44 tourist seats, eight sleeper seats, and eight "dormettes." The other four flights are DC-6B equipment with 44 tourist and eight sleeper seats.

SAS also has stepped up its transpolar winter flights from three to five weekly, and DC-7Cs have replaced DC-6Bs on the route.

• **Sabena Belgian Airlines** has added one schedule for a total of seven a week, all mixed and all but one in DC-6Bs with 12 first-class and 42 tourist seats. The seventh flight is a tourist-cargo DC-6A carrying 38 passengers and up to four tons of freight. In early January, Sabena will put DC-7Cs into transatlantic service. The airline has also increased its inter-Europe services with Convair 440s and is adding Sikorsky S-58s to its helicopter network.

• **Swissair** begins the winter season Oct. 28 with five DC-6B schedules, one of them first-class and the rest combination. Configurations are 50 tourist seats, eight berths (12 passengers) in mixed; 26 seats, eight berths in first-class. Beginning Dec. 16, Swissair will start phasing in its DC-7C equipment, carrying 47 tourist seats, eight berths and a lounge in the mixed; 26 seats, eight berths and a lounge in the first-class version. By Feb. 3, Swissair will be offering six DC-7C schedules weekly. Last year's winter schedules totaled five flights, one of them first-class.

• **Trans Canada Airlines** will provide seven winter schedules from Canada in Super G equipment, all of them mixed versions seating nine first-class and 54 tourist passengers. The total represents an increase of one flight over winter 1955-56.

Jet Engine Maintenance Symposium for Airlines

Tinker AFB—Symposium for airline personnel on field maintenance and overhaul of J57, J75, J79 and T56 turbine engines is being held here today, tomorrow and Wednesday. Symposium requested by the Air Transport Association, is sponsored by Oklahoma Air Materiel Area.

Medium Range Friendship

Fokker F-27 Friendship is being manufactured in U. S. under license by Fairchild Engine and Airplane Corp., Hagerstown, Md. Of short to medium range, craft is a 32 to 40 seat airliner with 1,600 shp. Rolls-Royce Dart turboprop engines. Fairchild version is priced at $540,000.

TCA, incidentally, offers no tours under the IATA 15-day excursion plan, just advises its customers that the rates are available.

Examples of other plans:

• **A $550 package** tour plan lasting 16 days (including travel time) in England, Scotland and Ireland (Sabena).

• **A 17-day package** to Rome, Nice, Paris and London for $670 (Pan American).

• **A 17-day swing through three** to five European countries at package prices of $644 to $767 (TWA).

Braniff DC-7Cs Enter Service

New York—Braniff International Airways placed Douglas DC-7Cs into domestic service this weekend on some of its schedules over New York-Texas and Chicago-Texas routes.

Originally, Braniff intended introducing its DC-7C El Dorado service on international routes to South America. Competition from airlines flying DC-7Bs and Super Constellations on Texas service forced a change in these plans.

Braniff now expects to put the DC-7C on South American runs next spring, perhaps as late as early June.

Braniff's first El Dorado schedules call for one round trip daily on each of these routes: New York-Dallas-San Antonio; New York-Washington-Nashville-Dallas-San Antonio; Chicago-Dallas; and Dallas-Houston.

Non-stop schedule between New York and Dallas is 4 hr. 40 min. southbound and 4 hr. 25 min. northbound.

Braniff's DC-7Cs have not been modified for the shorter-range domestic service.

Braniff's DC-7Cs (seven are on order with two delivered) all are arranged for combination first-class tourist service. Sixteen first-class accommodations are located aft of the main cabin entrance and buffet lounge section.

The other 12 are between the forward lavatories and the cockpit. This places the 35-seat tourist compartment between the first-class sections.

This arrangement forces the stewardesses to pass through the tourist cabin when providing service to the first-class passengers in the forward compartment. Some Brainiff personnel anticipate that this will create a bad situation. So the airline is prepared to turn the entire forward area ahead of the buffet lounge into a tourist class arrangement.

Shippers Urged to Use Air Cargo Services

Chicago—Stuart Tipton, Air Transport Assn. president, told shippers last week that it was pointless to wait for a "dream" air freighter with low operating costs because today's planes meet most air cargo requirements with "benefit to both airline revenues and business profits."

In an address before the Chicago Assn. of Commerce and Industry, Tipton said general misunderstanding of an airplane's cargo capacity has retarded air growth.

"Many shippers," he said, "don't use air freight today simply because they don't realize what it can offer in the way of lift."

Slick Move

Burbank, Calif.—Slick Airways will move its general executive offices from Burbank to Dallas. The move, scheduled to begin Nov. 15, is designed to improve communications between stations and produce better system-wide supervision. Closer proximity to Washington, D. C. and location in the central time zone were cited as advantages of the new site.

Slick's Burbank terminal and prime maintenance base will be improved and expanded. The company also is studying major metropolitan areas which may be served through more than one airport, such as New York-Newark, Fort Worth-Dallas, and Los Angeles-Burbank.

The airline reported a record 4,638,670 total of common carrier revenue ton-miles carried in September and a 13.5% growth to 12,650,707 ton-miles during the third quarter of 1956. The Burbank terminal handles 75,000 pounds of cargo daily, according to Slick, and a 50% or greater increase is expected within two years.

Overall Subsidies For Airlines Drop

Washington—Annual subsidy report for U. S. airlines shows that subsidy payments are continuing in a downward trend and will have dropped 30% between Fiscal 1954 the end of the next fiscal year.

The Civil Aeronautics Board's report estimates subsidy for Fiscal 1958 at $44.5 million and says all domestic trunklines and all transatlantic and transpacific operations will be off subsidy.

The subsidy estimate for Fiscal 1958 is down $19.5 million from the total for 1954, the first year in which subsidy and service mail pay were separated under Reorganization Plan 10.

Local-service carriers' subsidy will be up 11% to $26,871,000 in the four-year period, but the Fiscal 1958 estimate is down slightly from the $27,087,000 total for the current fiscal year.

Subsidy for helicopter operations will have increased by 58% between Fiscal 1954 and the end of Fiscal 1958 to a total of $4 million. Alaskan operations' subsidy will have decreased from $8.3 million to $7.4 million, and Hawaiian airline subsidy will be down from $689,000 to $283,000 in the same period.

Subsidy of $5.9 million is forecast for Latin American operations in Fiscal 1958. This represents a 64% drop from the Fiscal 1954 total of $16.1 million, and a slight drop from the $7 million estimated for Fiscal 1957.

TWA to Gain Jet Data With 'Paper' Program

Washington—Trans World Airlines will conduct a series of theoretical jet transport flights to gather jet operational data on its transcontinental and transatlantic routes. First of the simulated flights will begin within the next two months.

The airline will schedule the flights as though they actually had been incorporated into the company's daily operation. Flights of the "fleet-on-paper" will be conducted under standard flight procedures by TWA's dispatchers as they work regular daily flights.

The company said the flights will provide information on jet transport operations in relation to other traffic under current weather conditions that will help move the jets "right into TWA's fleet with a minimum of problems."

The test program is under the direction of Paul Frederickson, director of flight operations and chairman of the airline's 19-man jet planning committee. In addition to the simulated flights, the committee is conducting research with the Air Force, manufacturers and other airlines in preparation for Convair 880 jet transport service planned for 1959.

CAB Proposes Rules For Emergency Exits

Washington—New emergency evacuation rules were proposed by the Civil Aeronautics Board to cover new, high-capacity turbine transports now under design or construction.

The proposed regulations would bring present rules up to date and provide for transports with capacities of up to 239 passengers.

Under the proposal, which has been distributed for industry comment, transports would be required to have emergency exits in the flight crew area large enough to permit rapid evacuation. Transports designed to carry up to 20 passengers would be exempt from this rule if passenger exits were close enough to the crew area for effective use.

The CAB draft of the new requirements specifies four types of emergency exit:

- **Type I** would be a rectangular opening at least 24 in. wide and 48 in. high and would be a floor level exit. The first Type I exit would be as far aft as practicable, and the others would be spaced for maximum effectiveness in emergency.
- **Type II** would be rectangular and not less than 20 in. wide and 44 in. high. It would have to be at floor level unless placed over the wing in which case it would have a step-up of not more than 10 in. inside the airplane and a maximum step-down of 17 in. outside. The Type II exit would also be placed as far to the rear as possible, with other exits placed for maximum effect.
- **Type III** exit would be a rectangular opening not less than 20 in. wide and 36 in. high. If located over the wing, this exit would have an inside step-up of not more than 29 in. and an outside step-down of no more than 36 in.
- **Type IV** is specified as a rectangular opening at least 19 in. high and 26 in. wide with an over-the-wing step-up of 29 in. maximum and an outside step-down of no more than 36 in.

The proposal contains a scale of emergency exits required on each side of the fuselage for various capacities ranging from one Type III exit for a transport with 1-19 passenger capacity to four Type I exits for a 220-239 passenger transport.

For ditching, the rules would require at least one emergency exit located above the water line for every 35 passengers that are carried.

Delta Revenue Increases 13% Over Last Year

Delta Air Lines reports gross operating revenues of $66,600,000 for the year ending June 30, 1956, an increase of 13% over the previous 12-month period. Income totaled $7,951,000 for the 1955-56 period, and net income after taxes was $3,369,999.

Operating expenses for the year increased 10% to $58,649,000 according to the report. Delta carried 2,261,770 revenue passengers a total of 1,080,267,000 seat-miles during the period.

Available seat-miles totaled 1,726,940,000 and the passenger load factor was 62.55%.

The airline flew 118,544,000 revenue ton-miles during the year, and the overall load factor was 57.15%. Earnings per stock share were $4.70, and dividends amounted to $1.20 per share during the year, Delta reports.

Cooperation

New York-bound Delta Air Lines passengers weathered in at Philadelphia will reach their destination more easily through an arrangement between the airline and the Pennsylvania Railroad. PRR will accept Delta tickets for rail transportation.

The passengers will deplane at Philadelphia, receive coupons for taxi fare and tickets to New York on the railroad. Both companies use the same type of automatic ticketing machine.

CAB Adopts Emigrant Fare Plan

Washington—Civil Aeronautics Board has reversed itself to approve a cut-rate emigrant fare plan proposed by the North Atlantic airlines at the Cannes meeting of the International Air Transport Assn.

The Board approved the new emigrant fares by a three-two vote after expressing disapproval of the plan in a tentative decision in August (AW Sept. 3, p. 43).

At the same time, the CAB upheld its decision against allowing Eastern Air Lines to raise its Washington-Bermuda fare by the amount of the Washington-New York fare. Eastern operates its Washington-Bermuda flights via New York.

Switching its position on the emigrant fares, the Board observed that very little of the emigrant traffic between Europe and Canada and the United States travels by scheduled airline. This traffic amounted to approximately 200,000 passengers in 1955.

The new fare provides a 40% reduction during the off-season for emigrants from Europe to Canada or the U. S. Proponents of the fare argue that it will lure emigrant traffic onto the scheduled airlines and improve seasonal traffic imbalances.

CAB said that, where European emigrants with strict government visa requirements are a clearly identifiable class which is not now moving in volume by air, the granting of reduced rates cannot adversely affect other travelers and may, in the long run, help reduce the general fare level.

"Added to the economic basis for reduced fares for this particular class of travel is the fact that, historically, emigrants or immigrants have been the object of special government concern and consideration," the CAB said. The Board also said other governments have expressed strong interest in facilitating movement of emigrant traffic.

Italy and Spain were excluded from the emigrant fare plan at their own request, so the new fares do not apply to emigrants from these two countries or to nationals of Italy.

CAB Vice Chairman Joseph P. Adams called the fares discriminatory in his dissent. He said he favors lower fares but "not at the expense of inviting back abuses of the equal treatment principle." Adams feels the exclusion of Italian and Spanish emigrants makes the fares even more objectionable.

CAB Member G. Joseph Minetti also dissented. He noted that nationals of other European countries are unduly preferred over Italians and Spaniards and finds this fact sufficient grounds for disapproval whether Italy and Spain requested the discrimination or not.

Minetti pointed out that the cut-rate fare will not provide transportation on as economical terms as those already available on charter flights. He also said the fact that the fares are available only in the off-season indicates that the airlines are more concerned with filling empty seats than with helping emigrants and that this type of justification does not warrant approval.

Life-Preserver Rule Proposed by CAB

Washington—Civil Aeronautics Board is planning to require life preservers for all passengers as standard equipment on airline transports.

The proposed rule would require all transports, except those already equipped for over-water operation, to carry an individual life preserver or flotation device for each passenger. The CAB wants the rule to go into effect within a year from the date of adoption.

Life preservers would be constructed of inherently buoyant material providing a buoyancy of 16½ lb. and would have to be located within reach of each passenger and be easily removable. The device would have to be equipped with arm straps or some other easy means of holding on to it.

CAB's Bureau of Safety Regulation proposed the rule after the recent ditching of a Northwest Airlines Stratocruiser in Puget Sound, which cost five lives, and after a study of 12 other crashes on water which claimed a total of 25 lives.

Currently, transports on extended over-water flights are required to carry emergency flotation gear for passengers. In the past, this type of gear has not been required on overland flights since the risk of ditching was not substantial enough to warrant making the airlines carry and maintain life preservers.

Now, the bureau finds that the development of unicellular material provides a means of making seat cushions, pillows, blankets and similar items buoyant. The bureau says that such items can be used for life preservers by equipping them with arm straps or other means of hanging on to them.

Since such flotation devices would not be added equipment which would have to be maintained and inspected, and, in view of the recent Puget Sound accident, the CAB now feels that a requirement for some sort of life preserver on all airline transports is reasonable and necessary.

Northwestern University Opens Transport Center

Evanston, Ill.—The airline industry will be represented on the 23-man advisory committee of a new transportation center opened this month at Northwestern University "to meet the need for a fresh and integrated approach to transportation problems of steadily increasing complexity." The center will provide research and con-

IATA President

Lord Douglas of Kirtleside, (right), president of International Air Transport Assn., congratulates Thomas Delgado, Iberia, on his selection as president-elect for 1957-58, during 12th annual general meeting of organization at Edinburgh, Scotland.

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sultative services to the transportation industry, offer undergraduate, graduate and special courses in the field, and plans to develop a complete transportation reference library.

Aviation officials on the advisory committee are W. A. Patterson, president of United Air Lines; Stuart G. Tipton, president of Air Transport Assn.; Earl D. Johnson, senior vice president of General Dynamics Corp.; and Robert E. Gross, president of Lockheed Aircraft Corp.

Lake Central Awarded Portsmouth-Case Route

Washington—Civil Aeronautics Board announced last week that it will award a new Ohio local service route to Lake Central Airlines in the Portsmouth Service Case.

Lake Central will be authorized to operate over a new route between Cincinnati and Columbus via Portsmouth for a period of three years or until the CAB reaches a decision in the Great Lakes Area Local Service Case, whichever comes first.

The CAB announced its decision in a press release. The award will become official with the subsequent release of a formal opinion and order.

SHORTLINES

▶ **Avianca**, Colombian National Airways, will operate nine Super-G Constellation flights a week between New York and Jamaica this winter, including two all-tourist flights via Miami.

▶ **British Overseas Airways Corp.** is speeding transfer of cargo at London Airport through a streamlining of customs formalities. Documentation has been eliminated, and new, simplified procedures allow more rapid transfer of cargo between aircraft and among airlines at London.

▶ **Central African Airways** now has traffic rights at Rome for its Rhodesian Viscount service. The Rhodesian Viscount service, begun in July, operated with a passenger load factor of 88% during its first month.

▶ **Central Airlines** began issuing credit cards last week under the Universal Air Travel Plan sponsored by the Air Transport Assn. Central will continue to offer its own credit cards, which give travelers a no-deposit, 30-day account for travel over its system.

▶ **Israel's master plan** for Lydda Airport is moving forward with a project to lengthen runways for jet transport use. A new radio teletype service to London will be in operation by the end of the

Flotation Gear for S-55

Immediately available flotation gear, required by CAA, is fitted onto two Sikorsky S-55s flown by New York Airways. Gear, designed by Sikorsky with bags manufactured by Air Cruisers Co., Division of the Garrett Corp., weighs 161 lb., cuts about 10 kt. off top speed and 5-6 kt. off cruising speed. Pressure is 1½ psi.

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Unfortunately, all four wing recesses look basically alike. And one sure way to get involved in a time consuming, exasperating job of drilling out a screw or bolt is to grab the wrong type of four wing driver. But it can't happen with Hi-Torque. The only recess that looks like Hi-Torque *is* Hi-Torque! This distinctive, bow-tie recess instantly identifies it. And in case of emergency an acceptable Hi-Torque driver can be made in the field from a conventional straight slot screwdriver.

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year, and a pressure refueling system is scheduled to go into operation next spring.

► **International Air Transport Assn.** moved its headquarters last week from the International Aviation Building to larger quarters at 1060 University St. in Montreal. Telephone number and cable address are unchanged.

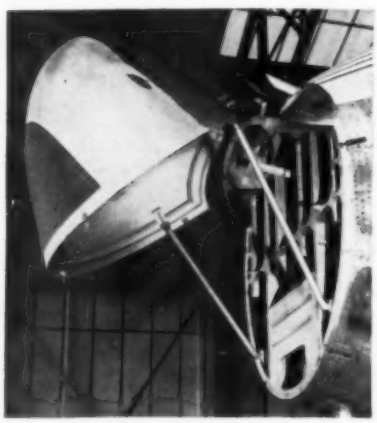
► **LAI,** the Italian airline, will operate four weekly flights between New York and Paris, Milan and Rome this winter.

► **National Airlines** is installing Burroughs Ticketeer ticketing machines in its Miami, New York and Washington ticket offices. The airline estimates the new machines will cut ticketing time in half.

► **Pan American World Airways** has added Philadelphia and Boston to its round-the-world schedule and now offers five flights a week between Philadelphia, Boston and New York and either San Francisco or Los Angeles. The flights are operated with DC-6Bs as far as Manila and Tokyo, and with Boeing Stratocruisers across the Pacific.

► **Swissair board of directors** has decided to float a $7 million bond issue bearing a 3.75% interest rate to finance its equipment program.

► **Varig Airlines** of Brazil has opened a sales office in San Francisco to develop traffic in the West Coast area.



Radar Nose

Weather radar will be mounted in noses of Viscounts for Capital Airlines and U. S. Steel Corp. New nose design adds 8 in. to length of aircraft, will accommodate all known types of radar employing a 22-in. scanner. Type of equipment fitted can be varied by changing mounting bracket on bulkhead. Modification kit will be made available to operators wishing to fit nose radar in earlier Viscounts.

AIRLINE OBSERVER

► First progress report by the Aviation Facilities Planning Group headed by Presidential Assistant Edward Curtis will be presented to airways users early next year. No details on specific types of equipment will be available by then, and discussions will be confined to a consideration of an "outline of concept for an airways system." The outline will be based upon estimates of traffic volume in the next 20 years and upon all types of equipment now available or in development. This is the first stage of the overall Curtis program which apparently is evolving on schedule. Since the plan will not have reached a concrete form by the time of the meeting, it is unlikely that a formal report of progress will be published.

► **Capital Airlines will sell its remaining two Viscount 744s subject to a June, 1957, delivery date when it has enough Viscount 745s to meet its needs. Of the three 744 models originally purchased by Capital, one was lost in a hard-landing accident at Chicago Midway Airport. Sale of the two aircraft will bring Capital's projected Viscount fleet to 72. The airline now has 42 Viscounts in service.**

► Lufthansa German Airlines will take steps to prevent the use of its internationally registered firm name by the East German line, which also goes under the name of Lufthansa. Legal action will be taken despite company belief that the filing of a complaint in courts of satellite countries will be futile.

► **Southwest Airways has applied to the Civil Aeronautics Board to change its corporate name to Pacific Airlines.**

► First scheduled feederline service in Southern Ontario is now being operated by Canadian Aircraft Renters between St. Catherines, Welland and Toronto. Company plans to add DC-3s to its present fleet of Grumman Goose, Beach C-45 and Cessna T-50 equipment.

► **Qantas Empire Airways last week took delivery of its first 1049H Super Constellation, three weeks ahead of schedule.. The aircraft will be fitted temporarily with 92 seats to handle Olympic games traffic, later will be modified to a combination passenger/cargo configuration.**

► Time-limit plan sponsored by the Air Traffic Conference to reduce the number of no-show passengers (AW Sept. 17, p. 39) has been moderately successful, according to several airlines. One airline reports a 5% reduction in no-shows, but the majority of companies participating in the conference agree that the problem will be substantially reduced only after monetary penalties are introduced.

► **Air-India International has decided on Rolls-Royce Conway bypass engines to power the three Boeing 707s it plans to introduce on routes to Europe and the U. S. in 1960.**

► Braniff Airways last week introduced its DC-7C schedule with a series of dinners, luncheons and demonstration flights in New York, Washington, Minneapolis, Chicago and San Antonio.

► **Lockheed's sales staff is back on the road pushing Electra sales after a calculated period of quiescence. The company held down its sales pitch while airlines took time to evaluate the medium-range Convair 880 design and Douglas DC-9 and Boeing 727 projects. Lockheed now feels that airlines have had a chance to review their equipment needs and are therefore ready for the next sales talk.**

► BOAC last week took delivery of its first DC-7C which will go into first-class service January 1, 1957 on the New York-London route.

► **In the 116 DC-7Cs Douglas has sold, a total of 55 different interiors has been ordered.**

Cessna T-37 designed for Jet Training

To meet jet age demands, the U. S. Air Force requires a jet trainer that makes it easy for cadet-pilots to master first-line combat airplanes.

The Cessna-developed T-37 introduces the cadet to all combat jet airplane characteristics while training on this safe, easy-to-fly jet trainer.

It is designed to provide the Air Force with a jet trainer that can be operated at substantial savings and cover the most important and longest phase of the cadet-pilot's jet training.

It is a privilege for us here at Cessna to team with the Air Force in its forward-thinking plans for the jet age. CESSNA AIRCRAFT COMPANY, Wichita, Kans.

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Be an Aviation Cadet. Inquire today about the future your Air Force offers from your Air Force Recruiting Office.

Plane Sales Increase Flying Tiger Earnings

The Flying Tiger Line earned $2,975,771 in net income and special items during the fiscal year ending June 30, 1956, the airline reports. Earnings, equal to $3.30 per share of common stock, compare with $400,188 or 45 cents a share for the previous year.

Operating profit accounted for $82,070 of the 1955-56 fiscal year earnings with the $2,893,701 balance deriving principally from sale and disposal of aircraft. Gains in traffic and operating income during the last quarter of the year offset losses experienced in mid-year, according to the report.

With the fleet addition of 10 Super Constellations in 1957, an increase of 30-35% in gross revenues for Fiscal 1956-57 is predicted by Robert W. Prescott, president of FTL. The carrier will experience a total business volume of $28-29 million in 1956-57, Prescott estimates.

National Net Profit For Year Rises 39%

National Airlines made a net profit of $4,300,143 after taxes during the fiscal year ended June 30, 1956, an increase of 39.81% over the previous year. Operating revenue was up 14% to $55,468,848, while operating expenses rose 10% to $46,277,799, according to National's 1956 annual report.

National carried 1,407,000 revenue passengers 987,188,000 miles during Fiscal 1955-56, achieving a passenger load factor of 65.76%. Revenue ton-miles totaled 110,265,000, air cargo ton-miles were 6,023,000, and air mail ton-miles totaled 3,408,000.

Fleet orders were increased during the year with placement of firm orders for 23 Lockheed Electras and six Convair 440s.

Available seat-miles for the period totaled 1,501,224,000, according to the report, and cost per available seat-mile was 3.08 cents. First-class passenger revenues increased 7.53% to $25,975,332, and coach revenues rose 21.52% to $24,313,655.

Western Declares 20-Cent Dividend

Western Air Lines has declared a regular cash dividend of 20 cents a share, the fourth cash dividend this year for a total of 80 cents per share. WAL also paid a stock dividend on Aug. 20 of 4%. The airline's stockholders at a meeting Oct. 10 voted to eliminate cumulative voting at elections of directors.

COCKPIT VIEWPOINT

By Capt. R. C. Robson

Wide Windshield

There has been more than a little discussion of late between the proponents of 100% control of air traffic and those who hold with the wide windshield view. As is so often the case, each theory has certain merits but neither can be accepted *in toto* at the present time. Undoubtedly, however, we are in need of many reforms in the traffic control system and there are surely aircraft flying today which are not overly blessed with outside visibility.

Strange as it seems, achievement of greenhouse vision is not necessarily an utopian condition. Too much glass up front can produce serious repercussions. Matter of fact one model of a new transport now being built has been criticized by pilots as having just that—too much glass. Here is the situation.

Not So Good

The need for better vision for pilots is not a new proposition—it just hasn't received a great deal of publicity until recent months. A few years ago various manufacturers had new aircraft designs on their drawing boards in which provisions had been made for large, unobstructed, windshield areas. And all who were informed of this feature said, "Fine." Now, several years later, in the mock-up, it turns out that all is not so fine.

In one sense most cockpits being built today are "standardized" affairs. That is, they are supposed to conform to numerous dimension standards. First you take a "standard" pilot and put him in his seat. The control column must clear this pilots "standard" knees in the full back, hard over aileron position. So this establishes the "standard" height of the column and the wheel.

Next we measure up from the floor a certain distance—42 inches is, I believe, the accepted number—and we arrive at the "standard" eye level. This determines the mid-point of the windshield. By incorporating the angular vision which our "standard" pilot must have down over the nose, as well as up, we learn the vertical dimensions of this pane of glass and the window frame is installed accordingly.

Substantial Thickness

But since we wish to eliminate as many posts and supports as possible our window frame must be of substantial thickness to prevent the glass from blowing out when under pressure at 30,000 feet—as well as from blowing in when colliding with flying ducks.

So far all sounds, "Fine." But wait. What happened to the instrument panel? Those "standard" knees have raised the control column until it nearly reaches the bottom of the window frame. In order to see the instruments our real live, non-standard, pilots are going to have to peer around, and under, and behind the wheel to see the gauges.

The view out the window is real Cinerama, no doubt about that. But the view of the approach horizon, the airspeed and altimeter on a low approach more nearly resembles a peep show. Not so fine. As one pilot quipped, "This makes for a real good taxiing aircraft."

Perhaps this all goes to prove that you can't please everybody. But the point I am trying to make is that pilots of large transport type aircraft necessarily must consider other factors besides a picture window. Outside vision at very high altitudes is almost useless, ditto when on instruments, and unless a clear view of all flight instruments is available low approaches can be hazardous. So next time someone complains of "too much visibility" he may not be flying entirely blind.

BRISTOL'S HISTORIC

The exclusive log-book record of the Bristol Britannia's recent U. S.-Canadian tour . . . how the "Whispering Giant" made an extraordinary flight operation possible.

Minutes before midnight, Sunday, August 12, a new Bristol Britannia turboprop airliner swept down a London Airport runway en route for Montreal.

Aircraft Baker-Jig was fresh from the production line. Tenth of thirty-three Britannias being built for B.O.A.C., she had logged exactly twelve hours' flight time before takeoff. Aboard were a special Bristol demonstration team set to show U.S. and Canadian aviation experts what their "Whispering Giant" could do.

This was the beginning of a historic tour that went like clockwork all the way. From the flight-log, here are excerpts that highlight the remarkable achievements of this unique flight operation:

London-Montreal in 10 hrs. 54 min. Over 3,400 miles non-stop against 40-mile headwinds.

Monday, August 13: Landed Idlewild, New York 7:33 a.m. On schedule. Ready for demonstration flight in 30 min. Total of 42 airline executives, 57 press members greatly impressed by Britannia's performance, particularly low-noise level. Demonstrations complete, prepare for nonstop transcontinental trip, New York-San Diego, carrying 18,000-lb. payload.

Tuesday, August 14: Strong headwinds, severe storms, cause wide detour. Britannia still makes nonstop trip in only 8 hrs. 26 min. Arrives San Diego with airline representatives aboard delighted by smooth, comfortable ride.

Sunday, August 19: Winding up successful West Coast tour. Remarkable reception at San Diego, Burbank, Los Angeles airports. Over 30,000 visitors walk through and inspect aircraft. Los Angeles reports 200 phone calls per hour from people eager to see "Whispering Giant."

Monday, August 20: Vancouver-San Francisco, 2 hrs. 59 min. Tuesday, San Francisco-Denver. Wednesday, Denver-Chicago. Demonstration flights in each area. Enthusiastic reception each stop for Britannia.

End Phase #1: "Operation Clockwork" aims to cover 28,000 miles in 18 days. Total time to date, 31.24 hrs. Total distance, 8,650 miles. Engineers report perfect mechanical

conditions, engine cowlings remain unopened since London.

Thursday, August 23: Chicago-New York after historic tour of seven major U.S., Canadian cities. "Whispering Giant" receives enthusiastic reception everywhere. Log shows 37 flying hours, 11,000 miles, 825 airline executives and press representatives carried to date.

Saturday, August 25: New York-Miami, where Florida is visibly impressed by the Britannia . . . the Governor of the Bahamas requests the "Whispering Giant" to make a special fly-past.

Monday, August 27: Miami-Washington, D. C. where officials praise Britannia's extremely low noise level and remarkable reliability.

Thursday, August 30: Peter Masefield, Managing Director, Bristol Aircraft Ltd., cables London: "Two demonstration flights from New York 29th. Reliability demonstrated on tour has created profound impression all airlines. Now only last lap to go."

Friday, August 31: Despite adverse weather, Britannia Baker-Jig flies nonstop Idlewild-London in 10 hrs. 18 min.—the only successful nonstop crossing that night. The "Whispering Giant" completes historic "Operation Clockwork" 100 flying hours after rolling off the production line ...88 flight hours, 24,000 miles after take-off from a London Airport runway.

From the record—for the record books: Britannia Baker-Jig was the first turbine-powered airliner ever to fly New York-London nonstop . . . and yet this is only the *medium-range* Britannia.

From the start of "Operation Clockwork," this production model Britannia flew 24,000 miles in 18 days, made 52 take-offs and landings in and out of ten cities in the U.S. and Canada, carried more than 1400 airline executives and press members on 32 demonstration flights.

Throughout, the engine cowls were opened only once. Total oil consumption was 11 gallons. Baker-Jig consistently beat scheduled operating times by up to 20 percent. Although average headwinds were 11 m.p.h., she achieved an average true air speed of 346 m.p.h. . . . while average hourly fuel consumption was 590 gallons.

From take-off to touchdown, the "Whispering Giant" showed her remarkable paces in what justly enters the record books as Bristol's historic "Operation Clockwork."

BRISTOL
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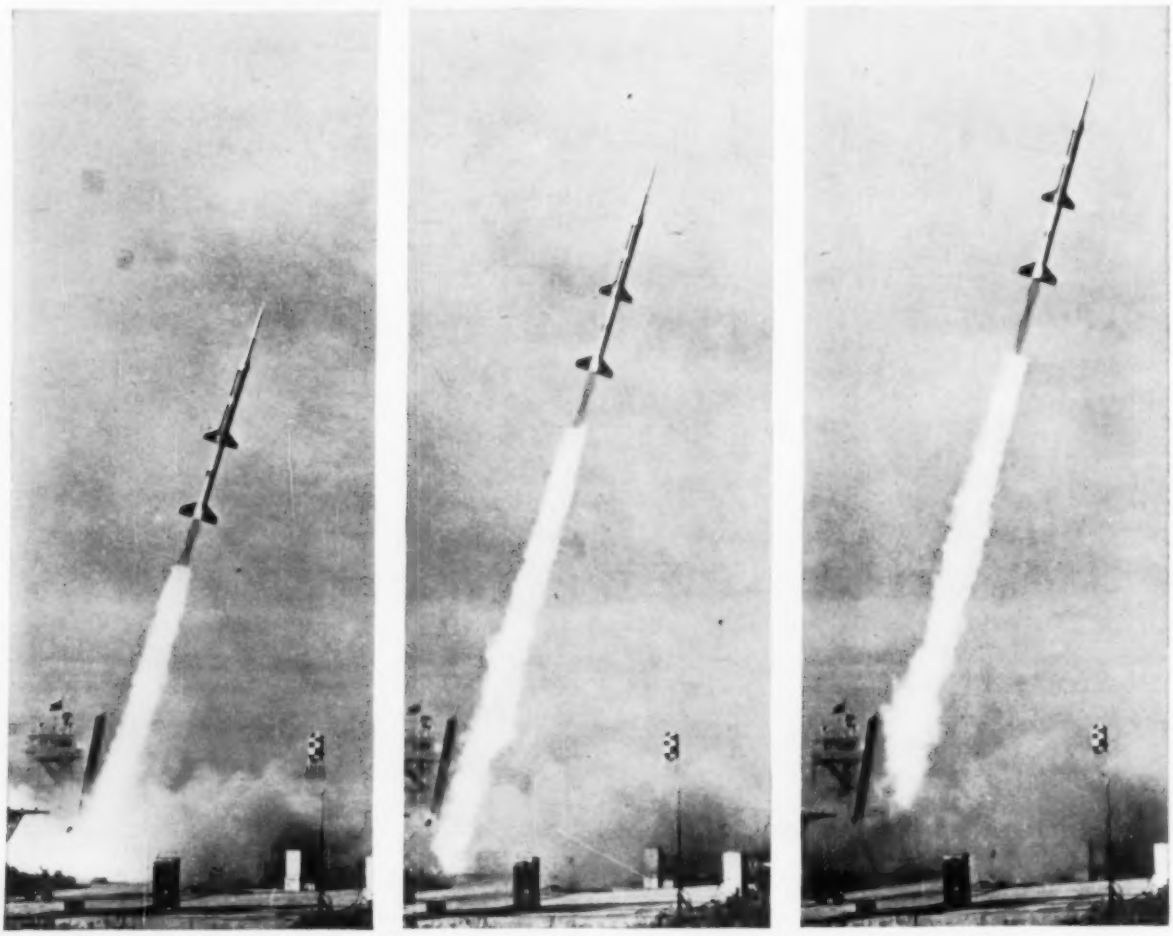


FOUR-STAGE hypersonic test vehicle roars off launching pad at NACA's Wallops Island Pilotless Aircraft Research Station.

NACA's Mach 10 Rockets Aid ICBM

By David A. Anderton

Langley Field, Va.—Design data for intercontinental ballistic missiles is one objective of hypersonic flight tests being made with multi-stage rocket-powered vehicles by the National Advisory Committee for Aeronautics.

Current concentration of the firing program is on heat transfer measurements. Later program expansion will aim at dynamic stability, pressure distribution and other basic aerodynamic data.

Most of the test vehicles launched at the Pilotless Aircraft Research Station at Wallops Island off the Virginia coast are three- or four-stage solid-propellant rockets with hypersonic performance. One of these test rounds, a four-stage unit using two Nike booster rockets and two smaller Thiokol rockets, reached a speed of Mach 10.4 at 84,000 ft. almost two years ago.

From this family of test rockets NACA expects to derive data that will simplify some of the tremendously complex problems which will continue to plague ICBM designers.

Various Vehicles

Latest four-stage rocket vehicle to be used by NACA's Pilotless Aircraft Research Division is started on its hypersonic flight by an Honest John motor. Second stage is a standard Nike booster; third stage is a Thiokol T-40 rocket.

The test vehicle itself contains the fourth stage motor, a Thiokol T-55 unit, as well as the necessary instrumentation to measure the data and transmit it back to a ground station by telemetering.

Size of the test vehicle is about six feet long, with a six-inch body diameter. Its nose is ogival, with a blunted tip that will be a design characteristic of long-range ballistic missiles. Another proposed ICBM feature, a flared tail, is used for stability instead of fins on the fourth stage. On a prototype ICBM the flared tail could have another advantage: provision of room for the motion of gimballed motors.

Test Model

An unusual materials test model, with a body ringed with metallic probes, has been developed by NACA to check the tendency of metals to ignite rather than melt at the high stagnation temperatures of hypersonic flight.

This model has a number of probes jutting out from the cylindrical body section. Each probe mounts a hemisphere of a different material, facing forward to receive full stagnation temperature and raised off the surface

of the model so that the hemisphere will be completely outside the boundary layer. Thermocouples in the surfaces measure heat transferred through the shock layer at the stagnation point at the front of the hemisphere.

A "two-headed monster" provides NACA scientist with way to check heat transfer at an angle of attack on bodies and wing surfaces. A pair of models is mounted on the nose of a Nike booster, with both models at the same angle of attack, but one at a positive and one at a negative value of that angle to the thrust line. This symmetrical displacement of the angled models means that the lift loads will balance and the whole vehicle will fly straight; both models will maintain a known angle of attack. The twin-pronged vehicle will be boosted with an Honest John motor, and the combination is expected to get to Mach 5.

Flight Paths

Two trajectories are commonly used by NACA to study the heating problems in hypersonic flight:

- **"Straight away"** in which all four stages are fired successively on the ascending leg of the flight path. This is the technique to be used in ballistic missiles to achieve maximum range.
- **"Over the top"** in which two stages are fired on the ascending leg, followed by a coasting period during which the vehicle passes through the zenith of the trajectory and starts to fall back to earth.

The remainder of the stages are then fired to achieve maximum speed in the thickest air, thus simulating the re-entry problem.

The success of any program using either of these trajectories hangs on precise calculation of the flight path, with exact stipulation of the firing times for each stage. It is general practice to use a coasting or a delay period between stage firings, and the length of these delays determines the trajectory just as much as the powered portions of flight do. Consequently a tremendous amount of trajectory analysis has been done to establish a series of optimum flight paths which vary with the vehicle chosen and the data desired.

Preparation Details

The high reliability of the solid-propellant rocket is the major reason that NACA has stayed with this type of powerplant all through its pilotless aircraft research program. Availability of the rocket motors has been an important factor also in sticking to the solid types. Without unlimited development funds, NACA must choose its powerplants from the available stock of military rockets; hence the use of Honest John, Nike and Thiokol charges.

Only the first stage of the four-stage vehicle is not physically fixed to the rest of the vehicle. It is separated by aerodynamic drag alone. The other stages are locked together.

For the second-third stage connection, a lock pin is used that is fired out at the appropriate time. The third-four stage connection is a threaded diaphragm, mounted on structure extending ahead of the third stage rocket nose. This diaphragm is screwed into the nozzle of the fourth-stage motor and solves two problems at once: connecting the stages rigidly and sealing the fourth stage motor from the extremely low ambient pressure at the time of its firing. Lack of such sealing has caused earlier test rockets to blow up after attempts at high-altitude starts in the extremely thin air.

Delay squibs developed by Hercules Powder are used to ignite the solid-propellant charges during a typical straight away trajectory. These squibs have been used for time delays up to 40 seconds.

But for the over-the-top flight path, where delays of up to 90 seconds are common, bomb-fuse timers are used.

Record Breaker

The test vehicle that roared through Mach 10 two years ago finally coasted to a peak altitude of about one million feet. It was made with off-the-shelf components: two Nike boosters, each 11 ft. long, served as first and second stages. Third stage was a Thiokol T-40 rocket, 4.5 ft. long; fourth stage sustainer motor was also a Thiokol unit, a T-55, and the overall length of the fourth stage was six feet.

The four-stage vehicle totaled 35 ft. 8 in. long, including the adapters and connections between stages. It weighed 2,800 lb.

The first stage accelerated the vehicle to Mach 1.4 at 3,000 ft.; this was followed by a coasting period of about 11 seconds, and the second stage was fired.

The vehicle reached Mach 4.2 at 22,000 ft., and again coasted for five seconds before third-stage ignition.

That powered portion of the trajectory took the model to Mach 6.7 at 65,000 ft.; after a short coast period—about two seconds—the fourth stage ignited and the model was traveling at Mach 10.4 at an altitude of 84,000 ft. when fuel burnout occurred.

Range Changes

These newer hypersonic test vehicles have forced an expansion of NACA firing range at Wallops Island. Navy cooperation has simplified the task; a fleet group working out of Norfolk helps in clearing and patrolling the area. Air Force pitches in from time to time to relay communications.

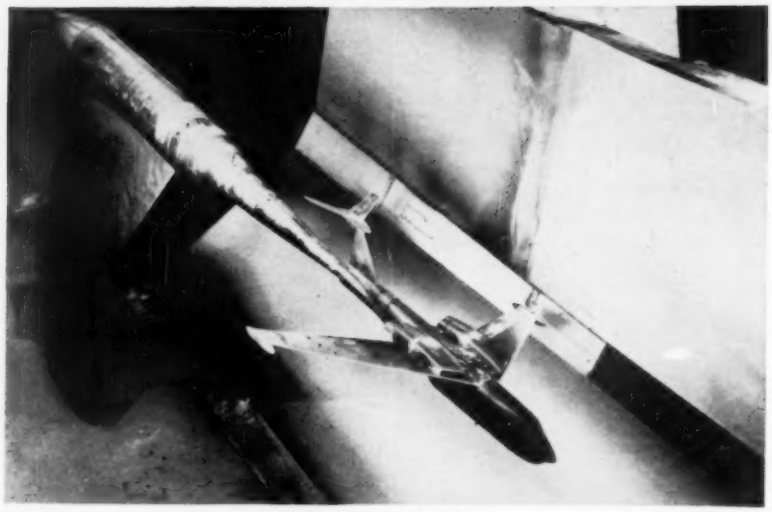
Most of the firings are scheduled for Friday afternoons between one and five. By then the fleet units are ready to go back to Norfolk for the weekend, clearing the exercise area of naval vessels and sending position reports on shipping back to firing control.

Search aircraft extend their training and help NACA at the same time by flying their problems over the fan-shaped danger area reaching out from the pilotless aircraft research station.

Range instrumentation is basically the same as used with the shorter range test missiles: telemetering, Doppler and SCR-584 radars for tracking. Missiles are Doppler-tracked on their ascending leg and that data, coupled with the telemetered information from the missile itself, defines overall performance of the vehicle.

For long-range flights Doppler is also used on the ascent, but skin-tracking with the SCR-584 set has proved a successful technique out to about 70 mi. slant range. This is in contrast to the expected tracking ranges of several hundred miles anticipated with the arrival of C-W monopulse radars at the Air Force Missile Test Center, Patrick AFB, Fla. NACA hopes to acquire

TWO-HEADED test vehicle measures heat transfer on two body-wing combinations simultaneously at an angle of attack.



Test Models

Static stability characteristics of North American F-100 at transonic speeds is studied with this scale model in 8-ft. transonic pressure tunnel at Langley Aeronautical Laboratory of the National Advisory Committee for Aeronautics. F-100 was fitted with enlarged vertical tail to provide greater directional stability and tests were made to substantiate modification. Model of Navy XP6M-1 Martin SeaMaster (below) undergoing study in 16-ft. transonic tunnel at Langley.

monopulse radars of its own to extend the tracking ability at Wallops.

Slant-range tracking extension can be obtained by using a beacon in the third stage, but even this gets lost before ignition of the fourth-stage motor. The indication from the radar track plus known dispersion patterns for the vehicles gives NACA trackers a pretty good idea of where the rocket is going to fall.

NACA's current work with hypersonic vehicles has a historical parallel in its work with transonic vehicles a few years back. Then it was a necessity to use rocket-boosted free-flight models to get transonic test data because of the complete lack of transonic wind tunnels.

But the ventilated throat concept solved the transonic tunnel problems. With their increasing availability over the past five years, the need for transonic test vehicle data has almost disappeared. But there is still work to be done in establishing supersonic interference criteria and in getting full-scale Reynolds' Number data for models of current design proposals.

The hypersonic test program is the only way now to get heat transfer and other data at hypersonic speeds under conditions duplicating those that will be encountered on an ICBM. Shock tubes, hot jets and other tricky means of getting hypersonic flow either have chemical or time limitations that make data-gathering only somewhat more refined than a qualitative process.

Today's multi-stage rocket vehicles are vast improvements over the subsonic units with which NACA started its program.

The hypersonic vehicles started with the Nike-Deacon rocket combination that produced Mach numbers around five. By using two Nikes and a single Deacon, this range was extended to Mach numbers of seven.

One of the first multi-stage rockets devised in an attempt to get closer to Mach 10 used the Honest John for a first stage, a Nike booster for the second, a cluster of three Deacon rockets for the third stage and a T-40 for the fourth. This latter vehicle, as its later relative, the Honest John-Nike-T-40-T-55 combination, has been used in over-the-top trajectory studies.

General Electric Will Build Research Plant

San Francisco—General Electric Co. has chosen a San Francisco East Bay Area site for a research facility that will design power plants for aircraft and guided missiles.

Already established in temporary quarters in Danville, 20 mi. east of San Francisco, the operation eventually will be transferred to nearby San Ramon, where a 12-acre site has been optioned. Plans call for a December construction start on a 7,000 sq. ft. building there.

The research operation is attached to the company's Aircraft Gas Turbine Division and will be under overall direction of the Flight Propulsion Laboratory Department in Cincinnati.

David Cochrane, general manager of the Flight Propulsion Laboratory, said the San Ramon group will design propulsion systems for use within and beyond the earth atmosphere, using any kind of energy adaptable.

Some 75 engineers will be located at the research facility.

GE Overhaul Symposium Planned for November

Cincinnati—A symposium on jet engine overhaul problems will be held at General Electric Company's plant at Evendale, Ohio, Nov. 14, 15 and 16. Program will include presentation of technical papers by military and industry personnel and informal discussion of overhaul problems.

Symposium originally was scheduled for October, but was re-scheduled.

Purpose is to produce platform for communication of ideas for improvements in field of overhaul and serve as vehicle for professional engineering recognition to overhaul personnel for past and present achievements.

SAE's Aeronautical Meeting Tackles Range of Problems

Los Angeles—The National Aeronautics Meeting of the Society of Automotive Engineers covered a wide area of problems facing the aircraft industry—from suitable ditching life rafts to heating effects from supersonic flight.

Speaking from the point of view of the pilot, Capt. R. F. Adickes, chairman of the Air Line Pilots Assn. and Trans World Airlines New Plane Evaluation Committee, touched on ditching, NACA's water inerting in a jet crash, and some performance factors.

He said that after a thorough study of NACA's water inerting system for engines to prevent fire after a survivable crash of a jet plane, ALPA has unqualifiedly endorsed water inerting in principle. "It is now the problem of engine manufacturers to develop its application to their product," Adickes declared. Water inerting should receive priority consideration over noise suppression, which has had considerably more effort applied to it, he said.

Ditching Accidents

Flotation for each occupant of the ditching type accident has been sorely neglected, Adickes contends. Over the past ten years there have been nine offshore ditchings of U. S. airline planes where several lives were lost due to drowning and several saved because seat cushions happened to be the type providing flotation, he says.

"ALPA representatives have pointed out repeatedly that a head pillow or seat cushion as standard equipment of all passenger airliners would make a suitable emergency type life preserver with slight inexpensive modification."

Life raft location also has been grossly neglected, he points out. Heavy, clumsy rafts are located in inaccessible areas, requiring carrying through narrow aisles to an opening for launching. The new transports, he says, promise greater ease of raft launching in a shorter time. Only now receiving attention is the location of rafts above the floor near the exits, to facilitate handling and launching.

In a new approach to suppression of jet engine noise, Douglas aircraft first devised a method of rating jet noises in five different ways, no one of which will indicate completely intolerable conditions all by itself, M. M. Miller said in a paper presented at the meeting.

Over-All Sound

To describe turbojet powerplant noise, Douglas has come up with a series of numbers including the over-all sound pressure level (OA SPL), the sample noise level (SNL), and sound power level (SPL), plus two angles, one the azimuth of the greatest (OCO SPL) measured on a polar plot of the unsuppressed engine, the other the azimuth of the same figure for moderately suppressed engine.

Douglas' investigation has shown, Miller said, that different engines on a jet transport yield their greatest noises at different angles from the plane, and additional angularity changes occur with suppression when the engine is in static operation.

For an airplane on takeoff, another noise measurement system is used, where the SNL, OA SPL and two angles are figured, but total flyby energy (TFE) replaces the sound power level of the static description.

Having devised a system which yields information which the designer can use in determining his standards for suppression, Douglas also has investigated several configurations of suppressors which indicate some promise.

Of the three ways to reduce noise at its source (the engine), a combination of two appears capable now of effecting the desired reduction, Miller said. Alteration of the jet mixing pattern and reducing velocities combined can get the noise down to the desired level for flight (takeoff and landing). However, the combined system must be retractable in flight to avoid even the slightest penalty at cruising speeds.

Corrugated Nozzle

Working on this basis, Douglas has tested a complementary combination—an ejector plus corrugated nozzle—a system Miller said appears simple, reliable, and capable of reducing the engine noise sufficiently to alleviate neighborhood complaints both in ground operation and in takeoff patterns near airports.

For supersonic airplanes, which have a limited center of gravity range, fuel

SAE Coverage

This comprehensive report on the National Aeronautics Meeting of the Society of Automotive Engineers at Los Angeles was prepared by Irving Stone and Richard Sweeney, members of Aviation Week's West Coast Bureau who digested the numerous papers submitted and conducted subsequent interviews.

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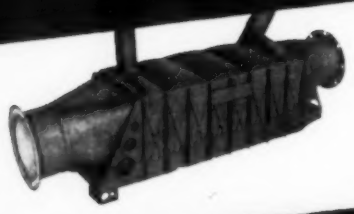

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management in relation to CG presents a serious problem, one which Grumman Aircraft Engineering Corp. solved using a lightweight mechanical system, Grumman chief powerplant engineer, John Karanik, told the gathering.

In its F-11F-1 supersonic fighter, Grumman had a tankage system whereby the forward main tank held 1.7 times as much fuel as the rear tank. Keeping the CG within range at high fuel loads and during aerial refueling was solved by incorporating a system which uses engine bleed air for muscle power, and a spring loaded valve which senses difference in head between the two tanks and has fuel automatically pumped as required to maintain the desired CG limits. The system includes a "memory" so that balance errors will be corrected rather than added.

Before the system was incorporated into the airplane, a mockup was constructed and the system given a thorough checkout on the ground in various attitudes and loadings. The bugs were largely removed from the system using the mockup, tests of which were conducted at the facilities of the principal vendor, Parker Aircraft Co.

Backstopping the primary balance system is an electrical fuel transfer system which also has been used to obtain test data on limit CG positions during flight tests.

Honeycomb Panels

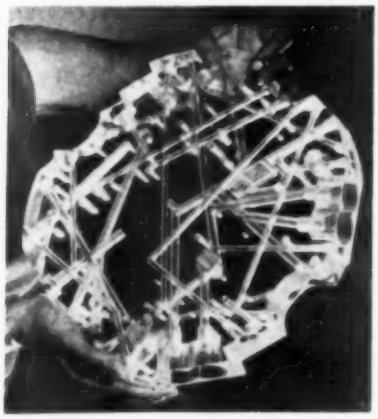
In a new approach, the possibilities of brazed all-metal honeycomb panels and the high-temperature brazing process in general, in gas turbine applications, were revealed by Solar Aircraft Co. engineers John V. Long, George D. Cremer and Richard S. Mueller.

This new accent on brazed all-metal honeycomb makeup is an ingenious extension of its already-established use in aircraft structures.

Brazed applications revealed were:

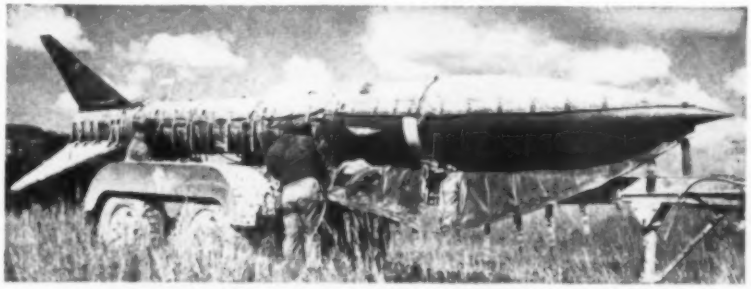
• **Turbine rub ring.** This experimental application is advanced as a possible solution to permit operation of the gas turbine rotor with zero tip clearance of the blades, to boost efficiency. The self-fitting rub ring consists of an open-face sandwich made up by braze-bonding the metal core to a backing sheet.

In the example cited by Solar engineers, the .004 in.-gage ⅛-in. square cell honeycomb core ends were smeared over as a result of direct contact with the turbine rotor in service. While blade interference was as high as ⅝ in., no galling or unbalance of the turbine



Compact Manifold

This compact manifolded mounting base for the hydraulic guidance system package of the Convair Terrier eliminates all external plumbing lines on the missile. The package itself contains 18 components, all of which mount on this manifold and are then interconnected through 15 feet of integral plumbing. Components can be readily removed for servicing and the entire system can easily be tested as a unit. Lines within the manifold lie in three different planes. The missile's hydraulic system uses compressed air to produce electrical power and wing actuation through servo valves and cylinders. Hydraulic power moves the remotely located roll actuator. Pacific Division, Bendix Aviation Corp., is the manufacturer.



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rotor blades resulted. Gas temperature was 1,750F.

No identification of the application has been made by Solar, but AVIATION WEEK has learned that a leading jet engine manufacturer has this specific use under consideration.

A projected modification of the rub ring application involves filling of the exposed core cells with various materials, such as a special sintered metal-ceramic mixture, to provide a relatively smooth wear-face which is strong, yet friable and non-galling.

• **Turbine nozzle diaphragm.** In this application, 24 turning vanes are tack-welded-positioned between a heavy outer flange and .067 in. inner shroud ring. The assembly is integrated by a high temperature brazing operation. A Marcel (AISI 1010) insert is braze bonded to the inside of the .025 nax vane. Cooling air forced through this Marcel keeps the low-alloy steel vane at acceptable temperatures.

• **Afterburner liner.** An experimental honeycomb sandwich for this service uses a novel core geometry. The .002 in., ¼ in. core cell is disposed at 45 degrees to perforated stainless steel sheet facings. By special techniques, the high temperature braze joining of the core and faces can be done without plugging of face perforations with braze metal. In use, cooling air is induced through the permeable faces into the hot blast stream.

• **Afterburner shroud.** This sandwich structure serves as a self-supporting air duct and thermal barrier. It consists of Type 321 foils .002 in. thick, brazed to Type 321 core with a ⅜ in. cell with foil .002 in. thick and ⅞ in. high. Lightweight Type 321 honeycomb shrouds operate up to about 1,300F. Brazed inconel shrouds will operate at 1,700F, with short time operation up to 2,000F, being feasible.

• **Piston.** This application would be for use with a high temperature actuator powered by air or gas bleed. One design under study involves a ¼ in. cell, .004 in. inconel core brazed to a backing ring shrunk onto a piston and rod assembly. Advantages of the open-face honeycomb are large overall support with minimum contacting area, low galling tendency through use of ceramic coating and low leakage rate due to labyrinth type design.

• **Heat exchanger.** Aircraft nuclear propulsion projects have spurred development of these high temperature brazed structures for use up to at least 1,600F. Another possible use is in jet engine compressor intercooling. In the heat exchanger mentioned by the Solar engineers, high transfer coefficients are obtained by foil corrugations intimately brazed bonded to separator plates. Marcel foil is .005 in. Type 321 in ¼

(Advertisement)

Valve Talk

FOR WM. R. WHITTAKER CO., LTD.
BY MARVIN MILES

The piled-high sandbags look like a bomb shelter, an incongruity set apart from other outside facilities at the Whittaker plant.

Actually it's a shrapnel shelter, in the most accurate sense of the term, for it's designed to do just that — shelter shrapnel, contain it and prevent it from injuring test crews.

Several times the heavy walls and roof of the shelter have been jarred with explosive force and a sandbag slashed deeply by hurtling chunks of metal.

For inside the protective structure a new steel-and-aluminum missile valve is undergoing development tests of explosive potential, manhandling terrific helium pressures up to 2000 pounds per square inch, reducing them to 400 p.s.i. and then down again to 50 p.s.i. operating pressure.

The shiny regulating unit takes the fight out of the enormous one-ton force that flows into it at super-hurricane speed, gentles it, and maintains the outlet pressure at a low constant with pneumatic brain intelligence.

Some day the design will be a vital part of a streaking ballistic missile, regulating inert gas pressures to force both fuel and oxidizer to bellowing rocket motors that thrust their lethal load through a vast trajectory over extreme range.

But today the valve is only testing its sinews, proving it can subdue the power that storms out of the long, heavy tanks.

And because the terrific pressure can shatter it into shrapnel during the development tests, the unit is shielded by sandbags (1) to safeguard personnel and (2) to contain all fragments for failure studies in case of an explosion.

The big pressure regulating valve is probably the most difficult challenge Whittaker has ever tackled — equal in time, cost and complexity to ten conventional valves — and its development has occupied a great portion of the company's engineering and laboratory facilities for almost a year.

Not only was there the problem of handling the gargantuan forces and reducing them; there was the infinite difficulty of designing the valve to maintain a constant (plus or minus one p.s.i.) pressure on fuel and oxidizer tanks despite shock waves, turbulence, chatter and hunting within the system's line.

Basically, this is accomplished by a unique pneumatic brain that senses when to increase or reduce the flow of gas and actuates spring-loaded diaphragms and constricting mechanisms operating in milliseconds to assure the desired 50 p.s.i. pressure within a fraction tolerance.

Whittaker valves, of course, have handled extreme pressures before, but never on a scale called for in the missile unit now under test — a unit about 16 inches long overall, with an average diameter of some 6 inches, and inlet port one inch in diameter and a downstream port of 3½ inches diameter.

Throughout the development engineers worked always with the fact in mind that increasing the size of a vessel for a given p.s.i. increases the explosive potential by the square of the diameter.

However, a relief valve is installed on the low-pressure side of the assembly to permit the quick escape of overpressures – just in case.

Still, Whittaker knew there have been injuries from just such development testing, recognized the dangers, and wisely took no chances with its personnel.

The test rig is reached by a circuitous route through the sandbags and is connected on the outside to a maze of instruments and dials, including a multi-channel oscillograph for checking the function of its pneumatic brain.

Whittaker has contract orders for a number of different versions of the pressure regulating valve and expects to go as high as 3000 p.s.i. in the exhaustive test program which the company is conducting jointly with a commercial laboratory.

As excellent as the valve is, however, may it never be used for the devastating mission it is designed to help achieve.

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in. spacing. Separators are Type 321, .010 in. thick.

Rohr Aircraft Corp. is anticipating future aircraft operating needs by preparing for the development of brazed titanium sandwich structure and other sandwich makeup to permit operation above 1,500F and 2,000F. Also, methods for fabricating large sandwich parts such as wings and fuselage sections must be found, according to Rohr Engineer H. M. Rush.

No identification of Rohr all-metal sandwich structures according to aircraft has been made, but reports are that parts have been made for Convair's supersonic B-58.

Problems still remain which challenge the fabricator. These include forming detail parts to close tolerances, holding fragile thin-gage core for machining, machining fragile core to close tolerances, critical cleanliness required, complex fabrication of brazing fixtures and joint design, Rush said.

Supersonic Propellers

Supersonic propellers, combined with improved turbine engines, indicate definite promise in propulsive efficiency for high subsonic airplanes, according to a paper delivered by Daniel H. Jacobson, chief of aerodynamics, and Robert A. Rogers, aerodynamics supervisor of aeroproducts operations, Allison Division, General Motors Corp.

Emphasizing the obtainability of long ranges and high speed with propellers, the paper noted that certain aerodynamic configurations, different from conventional subsonic propellers, combined with changes in design criteria, could effect high subsonic aircraft speeds using supersonic propellers.

The paper touched on the structural problems of a proposed supersonic design which used a small diameter, short chord, low thickness ratio and flat pitch, noting that torsional loads and conventional flutter provisions may have to be changed while the all important centrifugal stresses will be the major steady stress, calling for increased strength in hubs, blade changing mechanisms and other components in this area.

Some test data has been obtained with the Republic XF-84H and McDonnell XF-88B airplanes, the paper stated, which bears out wind tunnel and theoretical investigations. In general, the paper says, test results have indicated predicted performance to be slightly conservative.

Electrical Equipment

Highlights of the challenge facing designers of electrical equipment for future supersonic aircraft were outlined by Victor B. Hart, Boeing Airplane Co.

Moving into the supersonic flight regime elevates the relative degree of importance of electrical systems and

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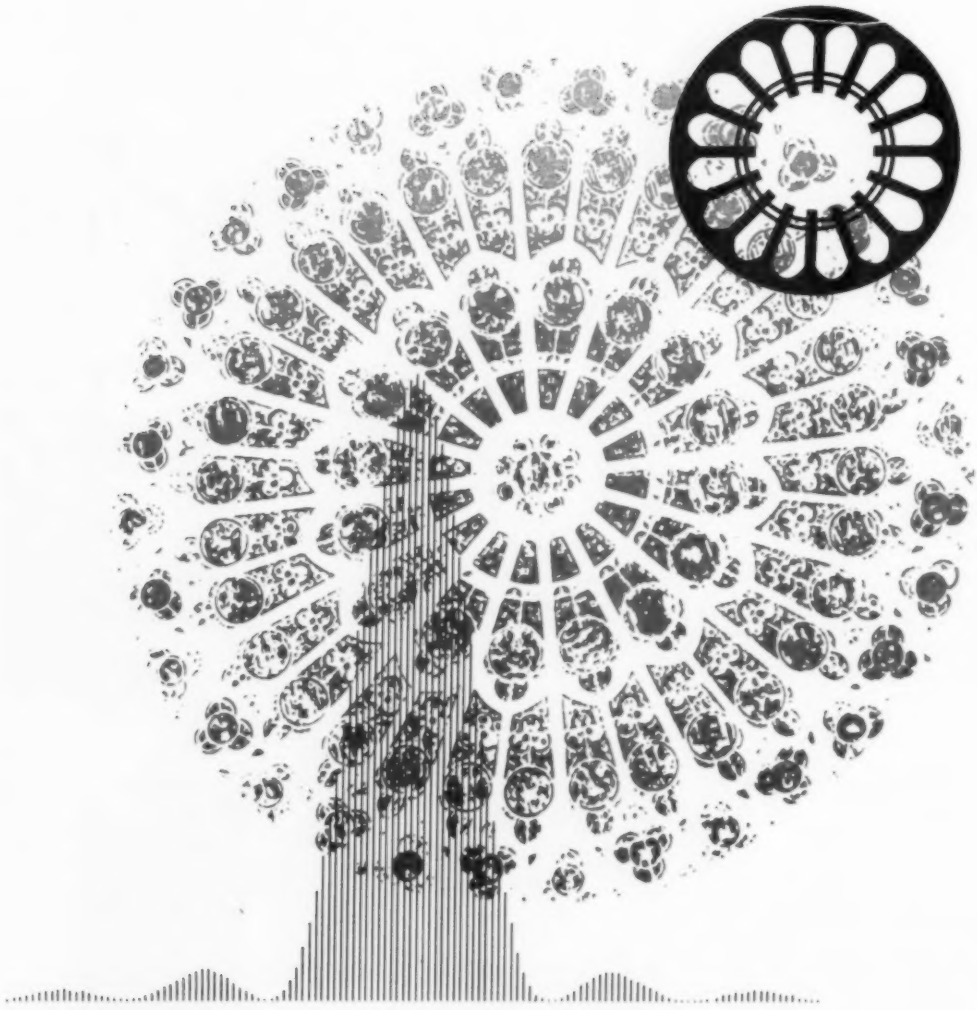

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components to the point where they may well become the limiting factor to the speed of the vehicle, he said.

Temperature is advanced as the most significant environment to affect materials and equipment in a supersonic vehicle.

Analysis of the limitations of presently available materials and projected improvements indicates that the equipment designer and manufacturer must, in some cases, discover new materials or develop new techniques for applying known materials, if the operation of supersonic vehicles is not to be compromised.

Electrical Resistivity

Increase in electrical resistivity of metals is one pronounced effect of temperature. Thus at 800F, resistance of copper is 2.8 times that of room temperature resistance, while nickel increases 6.4 times over the same temperature range.

Temperature also will have a significant effect on magnetic properties. At 1,000F, saturation flux density of iron cobalt alloy (representative of the new high temperature magnetic materials being developed) has decreased to 17 kilogauss, appreciably lower than room temperature level of about 22 kilogauss.

At 1,000F, silicon steel (used in rotating equipment, transformers) is more severely affected. Orthonol (nickel-iron alloy developed for magnetic amplifiers) is completely useless at this temperature, Hart said. While ultimate temperature limit of magnetic materials in general is about 1,000F, special applications may limit their use to a much lower temperature.

In future vehicles, noise levels will be sufficiently high that equipment may be excited directly by impingement of acoustic energy. Estimates are that sound level pressures for vehicles of the future will exceed 174 db.

Noise Effect

Little is known about the effect of noise on equipment, Hart pointed out. In the laboratory, military type vacuum tubes have failed after only a few minutes of exposure to 140 db. A sound level of 150 db. has been known to cause structural failure in existing aircraft.

Three design factors of high performance aircraft point to the need for a higher system voltage, Hart said. One of these is the increased electrical load, another is high altitude operation, while the third is increased ambient temperature corresponding to higher speeds. At 750F it will take 2½ times as much copper wire to conduct the same current as required at room temperature. This can mean a substantial weight penalty in a supersonic vehicle. Obvious

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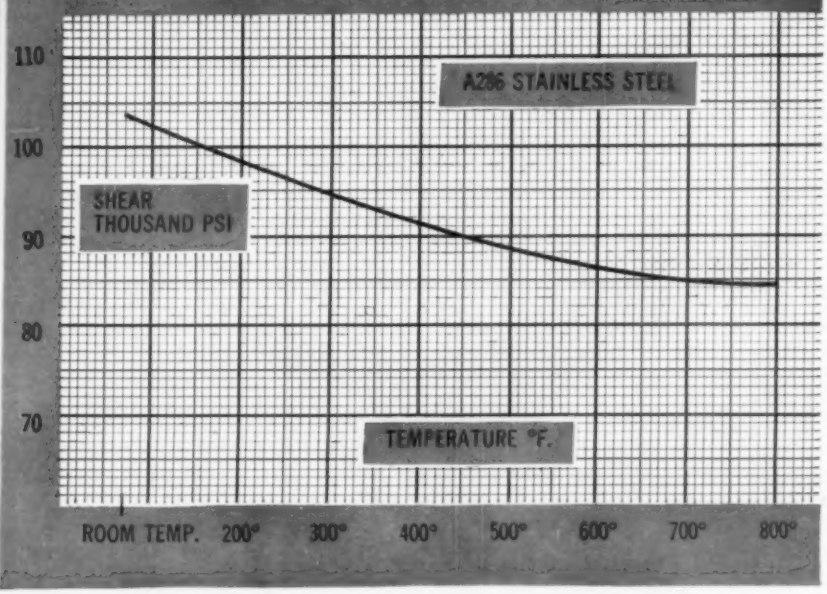

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method of reducing this weight, Hart claims, is to increase the system voltage.

As operating voltage is increased, Corona and ARC-over will require closer attention.

Sound Reduction

Airplane performance has grown by leaps and bounds while sound reduction efforts have been at a minimum over the years, resulting today in a situation whereby sound engineers have to advance at a breakneck pace in order to stand still (relative to keeping the passenger noise level tolerable, let alone reducing it to a more comfortable level.)

This, according to B. A. Rose, department manager of physics research, Lockheed Aircraft Corp., has resulted in his company setting up a pure sound investigation unit which has designed several pieces of equipment for its basic research task.

Equipment which Lockheed built to investigate sound problems include an anechoic chamber, a transmission-loss chamber, a propagation constant facility, an air duct noise investigation facility, a vinration test facility and a fuselage acoustical mockup.

Each of these tools is being used to break down sound origination points in the airplanes and at the same time, investigate ways and means of reducing sound by transmission damping, insulation, structural design or various other means.

A definitive ground operations plan can be the difference between a logical, realistic and workable weapon system, and one that is mired in doubt and confusion, Wallace E. Reese, Northrop Aircraft's supervisor of operations evaluation told the meeting.

Manpower

The available quantities of manpower and their skills will determine to a large degree the design philosophy for the weapon and ground support equipment, and dictate the extent and type of maintenance performed at the various levels.

It must be remembered, Reese indicated, that there are many unskilled, some semi-skilled, and few really skilled men in the service.

Until this trend is reversed, no one should design a system that cannot be handled by presently available type of manpower, he said.

To compensate for lack of skills and promote maintainability, ground support equipment should be as self-checking as possible and modulized to permit removal of an entire box or major subcomponents, Reese said. Where possible, equipment should be capable of trouble shooting with standard test equipment.

Thompson Building Development Center

Cleveland—Thompson Products, Inc., Cleveland, Ohio, is starting construction immediately on a $10 million engineering and development center on a 1,000-acre tract near Roanoke, Va.

Scheduled for completion in 1961, the facility for Thompson's Accessory Division will be used for testing fuel systems and auxiliary power systems for rockets and missiles. This division of the company is now engaged in both development and production.

Financed entirely by Thompson, the center when completed will consist of 14 buildings, including test cell structures, on a hilly terrain which is ideal for individual isolation for various test units.

It will be adequately supplied with water and electric power.

One of the prime considerations in selecting the site was its nearness to a number of technical schools from which Thompson hopes to recruit graduates and obtain part time and consulting services from their teaching staffs.

Initial operation is scheduled to get under way in 1957 with a staff of probably less than 100. The staff will be gradually increased to an estimated 500 when the facility has been completed. The testing to be done at this new center will support the activities of the Accessory Division at the company's Tapco plant in Cleveland.

"It will be an independent research and development center where the Accessories Division will carry out programs now in progress and planned in development of systems to be used in the missiles and aircraft of tomorrow," P. T. Angell, Accessories Division manager, said.

New ARDC Unit to Design Flight Control Displays

Wright-Patterson AFB, Ohio—A new branch to conduct research development, evaluation and integration of flight control system displays in all USAF aircraft has been established at the Flight Control Laboratory, Wright Air Development Center.

Known as the Design Engineering Branch, the facility will carry out plans for the Control-Display Integration Working Group. The group, composed of representatives of several laboratories and other WADC components concerned with aircraft instruments, determines the best presentation of instruments by missions and types of aircraft.

Head of the new Branch is C. J. Snyder. Sections and their chiefs are Display Engineering, Jack Kearns; Systems Integration, Maj. B. S. Emrick; Specifications and Standards, John Hart.

Republic F-84F Thunderstreak with some of the armament and fuel tanks it carries in addition to the A-bomb.

For Firepower, Speed and Range, It's Republic's Thunderstreak . . .

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The Thunderstreak's capacity of more than 6,000 pounds of bombs makes it the nation's most powerful fighter-bomber. Holder of the U.S. transcontinental speed record, the F-84F is also capable of global missions by refueling in flight. This technique enabled it to set the world's non-stop jet fighter long distance record of 5,118 miles from England to Texas. The F-84F is also highly effective for interception and escort missions.

The exceptional performance of the Thunderstreak was designed and built into it by men of vision and experience. They employ the best manufacturing equipment and materials such as Cherry rivets, setting guns and accessories used in fastening many components. The use of Cherry rivets in aircraft construction makes possible refinements of design and contributes to modern streamlining—helps achieve maximum flight performance. They also increase production, reduce unit costs.

Cherry rivet production, research and development facilities are located in the Santa Ana plant which is devoted exclusively to production of aircraft material. In this plant all guns, tools and accessories for setting blind rivets are also designed and made.

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FACILITIES OF NATO'S new Training Center for Experimental Aerodynamics include supersonic wind tunnel capable of speeds to Mach 2.3; composite low speed wind tunnel.

NATO Opens Aerodynamic Center

Rhode St. Genese, Belgium—Twenty students from 10 North Atlantic Treaty Organization countries will begin classes late this month at the new Training Center for Experimental Aerodynamics—a joint Belgian-U.S. project to give European technical talent knowledge of and experience with the most advanced aeronautical techniques.

The research facilities here, 10 miles south of Brussels, were built in the early postwar years to support an aircraft industry that failed to grow to meet expectations.

Alleviate Shortage

The facilities were on the verge of falling into disuse when the NATO Advisory Group for Aeronautical Research and Development (AGARD) decided last spring to try to alleviate the shortage of European scientists and technicians who had experience in the latest procedures for aircraft and missile research and development.

AGARD surveyed existing facilities in Europe, decided on the Rhode St. Genese center, and the Belgian government offered it for use. The agreement was signed Oct. 4 by the Belgian Minister of Communications and Lt. Gen. T. B. Larkin, director of the Mutual Weapons Development Program and European representative for the office of Dr. Clifford C. Furnas, Assistant Secretary of Defense for Research and Development.

The hope is that by the end of two years, all 15 NATO countries will be helping support the center financially.

Belgium's largest investment is in the existing facilities. Most of the U.S. funds involved will go towards modernization and up-to-date instrumentation of the aerodynamic research facilities, but the U.S. also is providing technological support and direction of operation.

Dr. R. P. Harrington has taken two years' leave from Rensselaer Polytechnic Institute's Aeronautical Engineering Department to serve as the center's technical director. His top assistant will be Dr. Robert H. Korkegi, who received his Ph.D. in aeronautical engineering from the California Institute of Technology in 1954.

Classes will be divided into quarters, with the student body gradually building up from the original 20 and the rotating technical staff increasing from the original half dozen as necessary.

Scholarships will be provided for students whose countries cannot afford to send them. Students will be drawn from colleges and universities, industry and the military services. The courses will be for two years—a year of study and a year of applied research.

Student Selection

Although the program is intended primarily for young post-graduate students and engineers, criteria for selection is left up to each NATO country's government. It is possible that older men with years of experience in the aeronautical industry will come here for study.

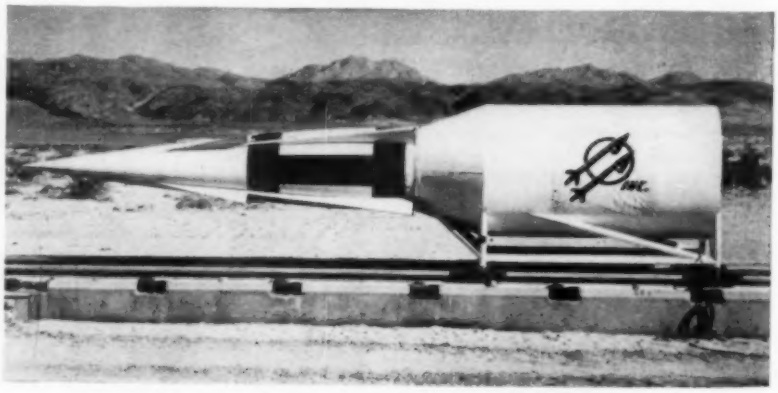
Facilities at the center now include:

- **A 16-by 16-in. supersonic tunnel** capable of speeds to Mach 2.3.
- **Composite low-speed wind tunnel** including a 10-ft. diameter open jet, a 10-ft. diameter vertical closed jet and a 6-ft. closed jet.
- **A 6-ft. diameter open jet,** low turbulence tunnel of the Eiffel type.
- **Metal and woodworking shops** adequate for fabricating wind tunnel parts and research models.
- **Optical and photographic** laboratories.
- **Drawing offices,** administrative offices and an auditorium.

Modernization Plans

Modernization with U.S. funds will include building of new nozzles at the center.

AGARD's decision to establish a cen-



Army Sled Reaches 1,300 mph.

Army sled, designed and built by Aircraft Armaments, Inc., Baltimore, Md., reached velocity of 1,300 mph. in less than 2.5 sec. The sled weighs 7,000 lb., and is propelled by three solid propellant rocket motors. The testing runs, for environmental testing of components, were made at the Naval Ordnance Test Station at China Lake, Calif. The company plans to try for runs at higher speeds.

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ter resulted from a growing recognition that, by and large, Europe's supply of technical talent had good academic background but little experience in aeronautical research.

The center's primary purpose, therefore, is to begin to fill this gap at minimum expense. It also will serve these purposes:

- **Broaden the technological pool** in Western Europe's aircraft, missile and electronics industries to the point where the NATO countries can become more militarily self-sufficient.
- **Provide a modern research** and test facility available to European companies and universities that do not have their own equipment. Testing fees will go towards support for the center's operation.
- **Advance scientific cooperation** and understanding among Western nations.

Nike Powerplant Details Revealed

Nike powerplant details were revealed by a Bell Aircraft Corp. engineer at the American Rocket Society's recent Buffalo meeting. In a paper which was barely cleared by Army Ordnance in time for the scheduled session and which has yet to be cleared for general publication, Bell rocket powerplant design engineer Joseph R. Piselli described Nike's 2,600 lb. thrust (at 10,000 ft. altitude) sustainer rocket.

Three years ago Bell was established as second source to Aerojet General Corp. for the Nike guided missile sustainer. Since that time Bell has brought the unit's performance up to a point that Bell currently is the only source which satisfies the revised Nike specifications.

The new specifications call for the sustainer duration to be extended to 35 seconds. AVIATION WEEK has learned that Bell's specific impulse of 212 seconds also tops that of Aerojet General's. Bell's efficiency is 97% at 60,000 ft. altitude.

The Bell objective has been to produce a relatively simple uncooled chamber and nozzle unit which, in an envelope 18½ in. long and 6¼ in. diameter and a weight of 20 lbs, is able to accept the 5,000F, 330 psia. burning of jet fuel with the red fuming nitric acid oxidizer.

To protect the chamber and nozzle against the combustion temperatures Bell lined the inside with Carborundum Co.'s Niafrax "A" ceramic. Although this sounds easier than the usual regenerative fuel cooling in a surrounding jacket, Piselli said that Bell found that there were many design and production difficulties.

The two largest headaches were nozzle erosion and manufacturing ir-

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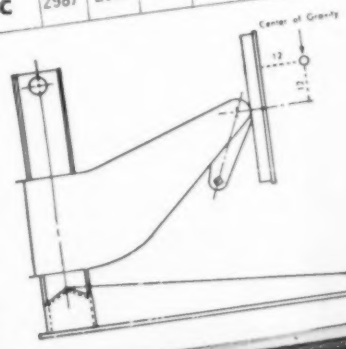
B	3000	2250	1800	1500	—	—	—	—	—
C	2987	2187	1725	1424	1212	1056	935	839	760



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regularity of the ceramic. Whereas the fuel-cooled nozzle problems are mechanical in nature, those of the ceramic uncooled nozzle are primarily chemical, explained Piselli.

The oxidizer jet was found to be eroding away the nozzle area as much as 100% with a prohibitive effect on the nozzle's thrust. A .010 in. change in oxidizer jet location eliminated this.

Bell had to learn to live with the ceramic in the factory. At first engineers were plagued with handling cracks and as much as 4,000% variations in ceramic porosity. Rather than a single solution they found that they had to develop new manufacturing standards and inspection routines to keep their ceramic quality under control.

A non-ceramic problem was a 165 cps. combustion instability which would oscillate back and fourth between increased combustion chamber pressures and reduced flow in the fuel feed lines until the condition built up into a violent "chugging" which would mechanically rupture the unit. Here again the solution was improved injector design.

Bristol Builds Engine Shop at Mexico City

Mexico City—Bristol Aroplane Co. of Canada, Ltd., Montreal, is building a $500,000 shop at the Mexico City International Airport to overhaul, maintain and repair aircraft engines up to 3,500 hp. A new company, Bristol de Mexico, S. A. de C. V., has been established as Bristol's first engine overhaul affiliate in Latin America.

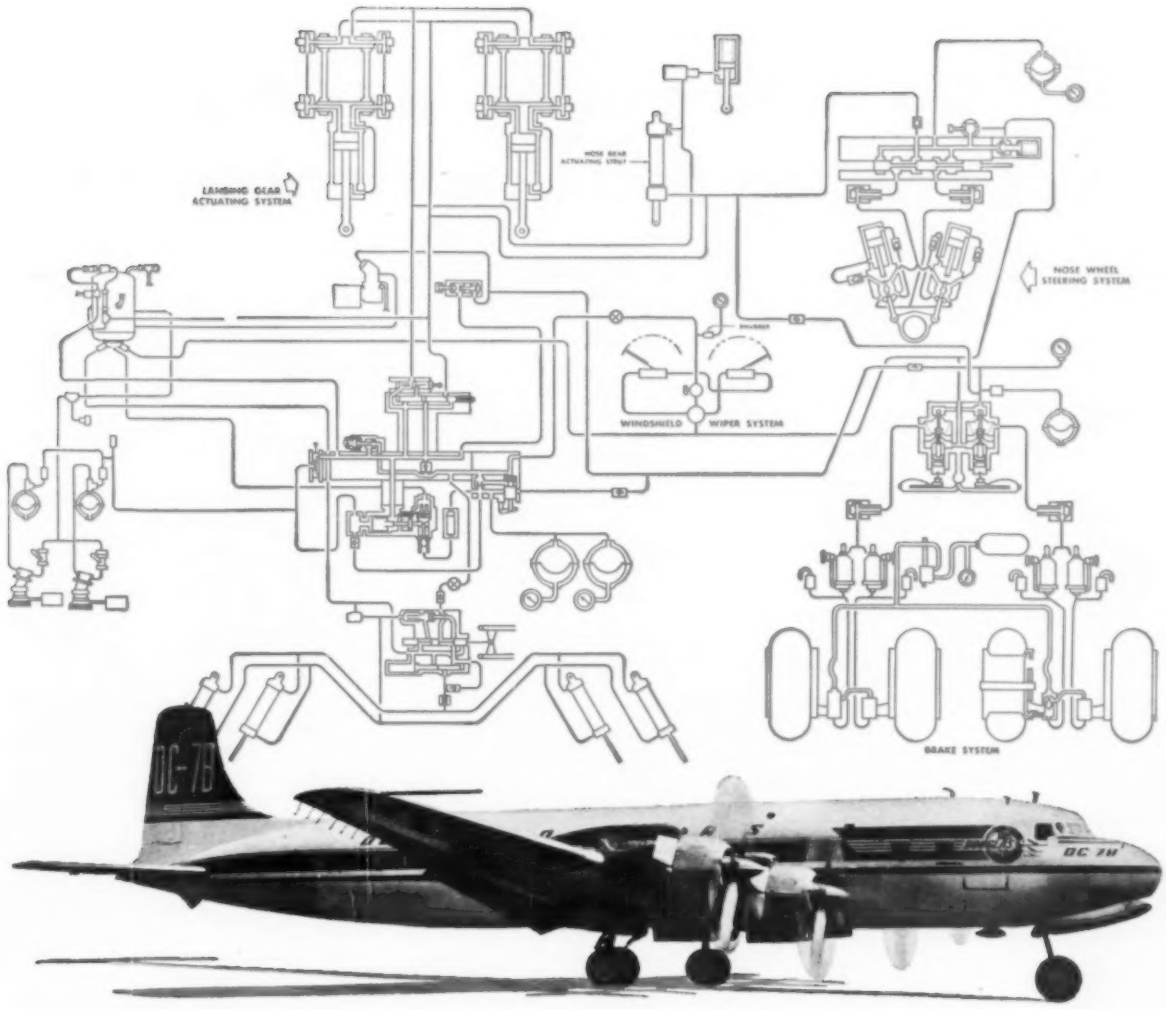
Heretofore, Aeronaves de Mexico, a Mexican airline, maintained a repair shop in Torreon for engines up to 1500 hp. All more powerful engines had to be sent to the United States for repair. Aeronaves will have about a 20% interest in Bristol de Mexico.

Initial operations will get underway at Brisol's Mexico City plant in March. The one-story, 3000-square meter plant is being constructed on a 30,000 square meter site. It includes two test cells, and will handle about 30 engines per month on one working shift. The test cells are being furnished by Janke & Co., Inc., Hackensack, New Jersey.

Steel, Titanium Press Goes Into Operation

The only steel and titanium extrusion press in the USAF's heavy press program is now in full operation at the Metals Processing Division, Curtiss-Wright Corp., Buffalo.

This horizontal press, the largest of its type to go into production, has a



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The Answer to Jet Age Accessory Power Problems

The need for hydraulic, electric, and mechanical power multiplies with every major advance in aircraft performance. The high air speeds of today's jets demand more hydraulic power for aerodynamic surface and braking control. Widespread use of electronic equipment has greatly increased electrical requirements. The blistering surface heat of high-performance planes only compounds the problem. Not only must today's designer plan an accessory system that can meet increased power requirements, in much less space, but he must be sure it can operate in hot environments.

Some accessory equipment now in use is grossly affected by heat. Direct drives attached to the engine, hydraulic motor drives, and gas turbine power units (GTPU's)—are extremely vulnerable to high ambient temperatures. In addition, they generate so much heat in operation that a method of removing the heat must be employed. Other limitations, such as inadequate lubricants, heat pumps, or the absence of extremely high-temperature metals may preclude the use of these methods if thermodynamic requirements continue to grow.

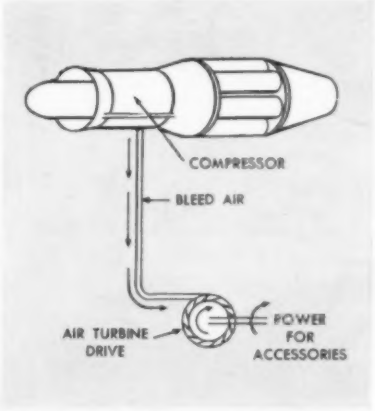
Heat Problem Changes The Design Picture

The heat problem has become so complex that top engineers now realize the importance of integrating the accessory system as part of the basic powerplant and airframe design effort. In the absence of adequate alloys to withstand high skin temperatures, designers now see the advantage of installing thermal-conditioning equipment and airducts as part of the airframe design in order to cool surface areas as well as internal components.

As a reliable, convenient source of compressed air, the jet engine provides the way to solve many of these problems. Air, extracted from its compressor, can be ducted to nearly any part of the aircraft surface for purposes of cooling, boundary-layer control, and deicing. Since the weight of this equipment is chargeable to the aircraft mission, it becomes practical to use the common energy source—compressed air—for operation of the plane's entire accessory system.

Air-turbine Drives Permit Integrated System

This trend casts new importance on the role and selection of accessory systems. With a compressed air supply already integral with the airframe, the use of air-turbine drives permits more effective integration of the airframe and the accessory system. In many installations, the same air used in the existing airduct system can be used to spin small turbine wheels mounted on shafts. These, in turn, drive generators, hydraulic pumps, fuel pumps, thermal-conditioning equipment, mechanical actuators, and other accessories.



Turbines Run on Air Ducted from Compressor

Operating on this simple principle, air-turbine drives can effectively perform nearly every accessory function aboard jet or turboprop aircraft.

Simpler Construction—Greater Reliability

Air-turbine drives are inherently more reliable because they require fewer moving parts than any other method of generating power. Only one efficient, rotating turbine wheel and shaft is required to drive the plane's electrical and hydraulic units. Completely automatic operation is obtained by an integral control system. Whenever a load demand occurs, a system of signaling and actuating devices changes the unit's output to meet the power requirements.

Reliability of an air-turbine drive system is achieved by cross-manifolding the plane's air supply ducts. Through this method, all units on the aircraft can operate from one or any combination of engines. In multi-engine aircraft, failure of one or more engines would not mean loss of accessory power as long as one engine remained to supply bleed air.

The operating history of units now in use, such as those on Boeing's B-52, shows that the simple, comparatively friction-free construction of air-turbine drives can greatly minimize wear and result in longer, more dependable service. In addition, they permit more effective paralleling of generators if required, and with a ground source of air, can be tested without running the main engines.

Install Where Power Is Needed

Air-turbines Permit Functional Location

Air-turbine drives and the accessories they operate may be located anywhere in the plane where power is needed. In the B-52, for example, ten hydraulic turbopumps are distributed in both wings and the fuselage—close to the point where power is needed. Such versatile, functional location is possible because air is relatively easy to transport and because it requires no return system.

Located away from the engine, these drives can contribute to a sleeker airframe design by cutting engine nacelle size and reducing frontal areas. Also, by installing them close to the "service area," short hydraulic and electric transmission lines can be used. This results in a lighter and less complex system.

These advantages permit a significant increase in aircraft speed and range, or payload.

Forecast for the Future

Ramjet and Nuclear Powerplants—It is expected that air-turbine drives will play an increasingly important role in the future. In aircraft utilizing a turbo ramjet,

the turbojet portion of the engine may be shut down during the supersonic portion of flight. This would mean that no mechanical power would be available from the main powerplants for accessory operation. A pneumatic system, however, could provide accessory power under such conditions.

Another indication that more accessory power will be needed in the future exists in the anticipated requirements for nuclear-powered aircraft. Large amounts of power may be needed for specialized functions associated with the reactor. Remotely located air-turbine drives, linked with an auxiliary power unit, could supply a huge block of power without a prohibitive increase in unit weight or size.

G.E. Pioneered Air-turbine Drives

General Electric's Aircraft Accessory Turbine Department in Lynn, Mass. is one of the nation's prime suppliers of air-turbine drives for aircraft accessory power.

Drawing on G.E.'s vast experience in producing industrial and aircraft gas turbines, this department has consistently advanced the state of turbomotive equipment design.

Just as General Electric pioneered the "radical" aircraft turbosupercharger in 1918, through the Aircraft Accessory Turbine Department, it is now building air-turbine drive equipment to answer the accessory power problems of the jet age.

G-E Turbopumps and Turbodrives help supply all hydraulic and electric power on the Boeing B-52 Stratofortress, first aircraft in history to use pneumatic-driven power equipment for operating its entire accessory system.

Driven by air ducted from the jet engines, G-E turbopumps and alternator drives supply 8 gpm at 2650 psi and 60 kva at 400 cps, respectively. They give the big bomber power for operating steering, control surfaces, landing gear, bomb-bays, spoilers, radar, lighting, and armament.

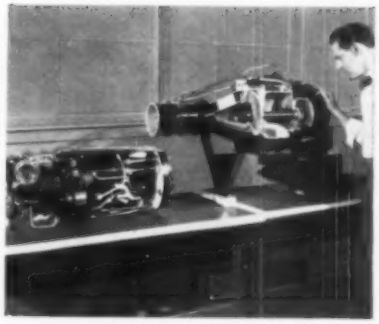
G-E Fuel Turbopump

This tank-mounted, air-driven unit provides 86 gallons of vapor-free fuel per minute, giving North America's F-86D interceptor the extra fuel needed for afterburner operation. Characteristic of G-E air-turbine drives, the Afterburner Fuel Pump is lightweight and compact and can be functionally located in the aircraft.

G-E Turbostarters

Another application of the versatile turbine is in the self-contained turbostarter (used on the Martin B-57) which starts a jet engine in less than 10 seconds.

It is powered by hot gases resulting from the combustion of an easily replaceable solid-propellant cartridge. Turbostarters eliminate the need for ground power starting units, minimize logistics problems, and increase jet aircraft availability.



G-E Turbopumps and Turbodrives Help Power B-52's Accessory System

G-E Afterburner Turbopump Gives North American F-86D Instant Power Reserve

G-E Turbostarter Gives Martin B-57 Quick Starts. G.E. Also Makes Fuel/Air Starters

Advanced Air-turbine Drives Are "In the Works"

General Electric's Aircraft Accessory Turbine Department, with facilities valued at more than $15 million, is carrying out an extensive development program on advanced air-turbine equipment. Units with extremely high power-to-weight ratios are already in advanced stages of testing. These programs promise powerful answers to accessory power requirements that lie ahead.

To find out how G-E air-turbine equipment can help you now in the planning stages, contact your General Electric Aviation & Defense Industries Sales Office or write for the descriptive brochures on the drives you are interested in.

General Electric Co., Section 8231-8, Schenectady 5, N. Y.

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The company's 50,000-ton and 35,000-ton forging press which have been producing the four main wing spars for the Air Force's supersonic F-102A, have saved $13 million on current orders alone over conventional built-up spars. The new steel and titanium press is expected to give commensurate savings.

DC-8 Test Facilities Advanced at Douglas

Santa Monica—Construction of engineering test facilities for the DC-8 jet transport program is being advanced at Douglas Aircraft Co., Inc., here.

Facilities include an acoustics laboratory which will house a reverberation room where materials will be tested for fatigue resistance to high intensity sound. An anechoic chamber will check sound radiation characteristics of compressors, turbines and other airplane components.

A control systems laboratory will be used for experimentation with full-scale working models of the DC-8's aerodynamic controls.

Other installations will include a pneumatic systems laboratory, a static test facility, and an addition to the electrical systems laboratory.

Construction also has begun on structures for testing guided missiles, including two 60-ft. towers and a 100-ft. tower for proof and calibration testing.

Bacteria Corrosion Jams Canberra Pump

London—Mysterious form of corrosion that jammed fuel pumps of Royal Air Force Canberra jet bombers operating in Malaya earlier this year, causing them to be grounded, has been traced to microscopic bacteria. These turned sea water into sulphur, which reacted later with silver in the fuel pump system.

The Chemical Research Laboratory, Teddington, which traced the cause of this damage, announced it is now using successfully the same type of bacteria to manufacture valuable sulphur from London sewer sludge. These experiments are expected to lead to sulphur production on an industrial scale.

While a Teddington research team

was working on plans to utilize bacteria found in ponds and lakes, the leader of the team, Kenneth Butlin, was consulted by Rolls-Royce about the mysterious corrosion that was jamming the fuel pumps of jet planes in Malaya.

It was found that bacteria had entered fuel storage tanks from water which was used by tankers to wash out under-sea delivery pipes. Covered by oil and in oxygenless conditions where they thrive, these bacteria were turning sea salts into sulphurated hydrogen. This gas in turn dissolved in the aeroplane fuel as it bubbled upwards. Later it reacted with silver parts of the aircraft fuel pump and corroded them to a point where they were useless.

According to the Department of Scientific and Industrial Research, the same ideal conditions for bacteria of this sort exist in London sewer sludge.

WHAT'S NEW

Publications Received

• **The Legal Status of Aircraft**—by J. P. Honig—Pub. by Martinus Nijhoff N.V., 9 Lange Voorhout, The Hague, Netherlands, approx. $3.25; 214pp.

Of interest to those who are working on the development of international air law, this book analyzes the problems concerned, and deals comprehensively with questions of both public and private law.

• The following five paper were presented at the SAE National Aeronautic Meeting in New York in April, 1956. They may be obtained from the Society of Automotive Engineers, Inc., 29 West 39th St., New York 18, N. Y.:

Development of a Cabin Pressure Control System for Transport Type Aircraft—by Everett H. Schroeder.

Integrated Flight Systems—by Ben F. McLeod.

Pneumatic vs. Mechanical Power Extraction for Aircraft Accessories—by Richard L. McManus.

Suppression of Jet Engine Noise During Ground Running—by J. M. Tyler and R. Krieghoff.

The Development of Rolls-Royce Propeller Turbine Engines—by D. P. Huddie.

• **"The Aeroplane" Directory, 1956**—Compiled by the Staff of "The Aeroplane"—Pub. by Temple Press Ltd., Bowling Green Lane, London, E.C.1, England. 21/d; 586pp.

The Directory provides a complete guide to all branches of Aviation throughout the British Commonwealth.

• **Airline Transport Pilot Rating**—by Charles A. Zweng and Allen C. Zweng—Pub. by, and available from, Pan

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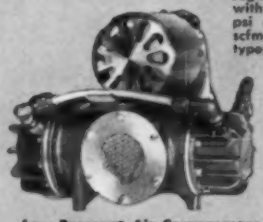

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American Navigation Service, 12021 Ventura Blvd., North Hollywood, Calif. $5.50; 354pp.

A text for the pilot who wishes to qualify for the Airline Transport certificate, this book contains material on all the subjects included in the written examinations, as well as considerably more on the theory of navigation, weather, instruments, radio, etc.

• **The United States Air Force Dictionary**—Edited by Dr. Woodford Agee Heflin—Pub. by Air University Press—Available through the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 578pp.

A comprehensive analysis of the United States Air Force vocabulary and its special adaptations of the English language, the dictionary is designed for all interested persons.

• **The International Dictionary of Physics and Electronics**—Pub. by D. Van Nostrand Company, Inc., 257 Fourth Ave., New York 10, N. Y. $20.00; 1004pp.

Prepared by an international group of distinguished scientists and educators, the dictionary contains definitions of all the principal terms used in classical and modern physics, and includes, for those who do not have an extensive mathematical background, both explicit and discursive statements and entries.

This is the first of two volumes which will constitute a general and very complete text on forecasting which aims at minimizing, in accordance with the current trend, the difference between synoptic and dynamic meteorology. In Volume I, the emphasis is on the dynamics of atmospheric processes.

• **Resistance Welding: Theory and Use**—Prepared by Resistance Welding Committee, American Welding Society—Pub. by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $4.50; 163pp.

A handbook on welding the thinner gauges of all kinds of metals, it presents every aspect of resistance welding from basic principles to most effective use.

• **Vision, A Saga of the Sky**—by Harold Mansfield—Pub. by Duell, Sloan and Pearce, Inc., 124 East 30th St., New York, N. Y. $5.00; 389pp.

Using narrative techniques, the author recounts 40 years of progress in the air, the trials and triumphs of the Boeing Airplane Company.

• **Thunder Above**—by A. J. Wallis and Charles F. Blair, Jr.—Pub. by Henry Holt and Co., 383 Madison Ave., New York 17, N. Y. $3.50; 253pp.

This is a novel about the imprison-

a Campus way of life for creative engineers

Here at McDonnell Aircraft Corporation aeronautical engineering history is being made by our new "Engineering Campus." The architect's rendering of this 16-acre development adjoining our plant gives an idea better than any words of the great steps being taken at McDonnell to provide its engineers with a new kind of work environment for creative thinking and effective achievement.

The development's imaginative scope, colorful beauty and detailed attention to working comfort are attracting nationwide attention as a logically ultimate answer to a vital need of the aircraft industry. One building is completed and occupied, and a second is already under construction. The entire group upon completion at a cost of more than $6,000,000 will comprise integrated facilities of, by and for engineers.

This latest chapter in McDonnell's record of pioneering achievements is another significant indication why the company in only 17 years has grown from two individuals to a team of more than 17,000 persons. We are now working on a backlog of orders for fighters, missiles and helicopters that exceeded two-thirds of a billion dollars on June 30.

Newest McDonnell planes in production for national security are the versatile F3H-2N Demon, fastest all-weather fighter in the Navy, and three different versions of the world's most powerful fighter, the supersonic F-101 Voodoo, for the Air Force. Work is in progress on four advanced missiles, including Talos.

We salute the engineers who have done so much to make possible our contributions to the nation's airpower. We believe a good part of the accomplishments stems from a fundamental policy that takes into account the highly individual capacities and aspirations of able and productive men. The "Engineering Campus" program is our direct-action pledge to our engineers—those now at McDonnell and those who will join them—that we are determined to maintain and develop further an environment that fosters the sort of creative achievements on which continued progress depends.

Professional and economic advancement await qualified engineers at McDonnell Aircraft. We provide free in-plant engineering courses taught by our own top engineers and sponsor graduate and undergraduate programs at the two outstanding universities in St. Louis. We invite you to investigate joining our team of the ablest minds in aeronautics — united in making fundamental progress in advanced airplanes, helicopters and guided missiles—by writing to R. F. Kaletta, Technical Placement Supervisor.

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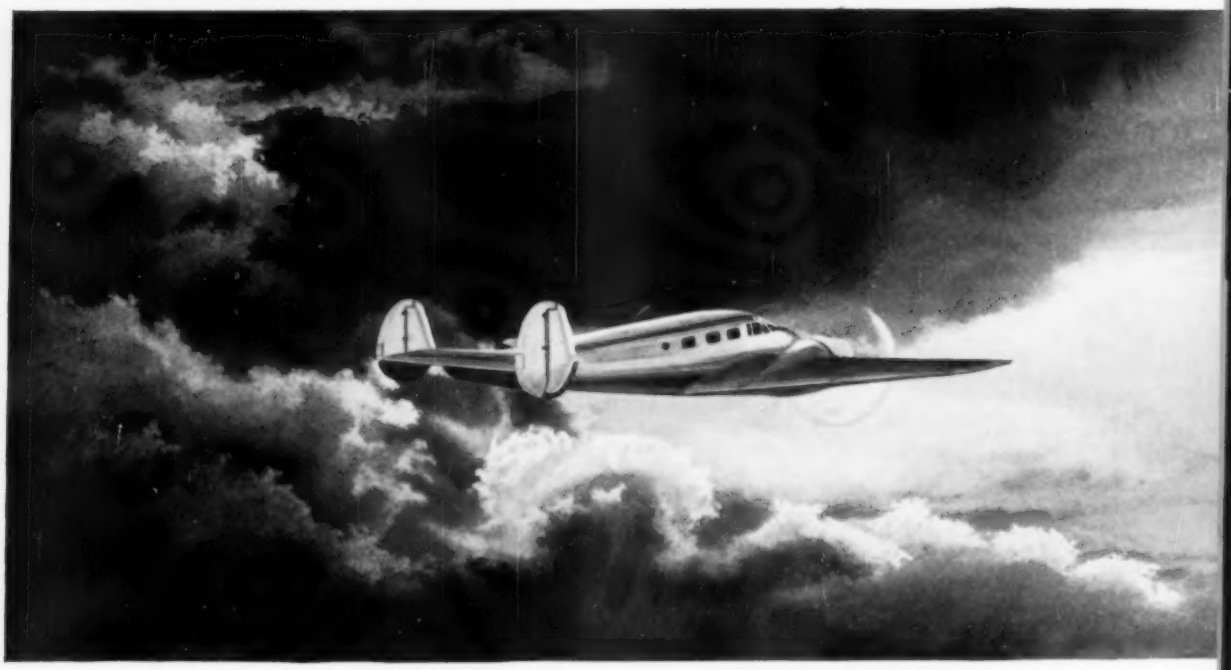

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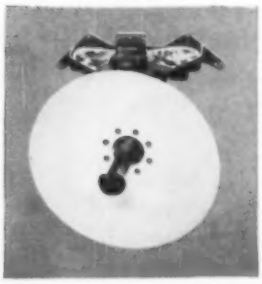

Typical Antenna Installation in Beech D-18

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ment and escape of two American pilots who are forced down into the Russian Zone of Germany. One decides to re-enter East Germany to rescue the plane's stewardess whom he loves; follows a hair-raising chase as they try to elude enemy pursuers.

• **Electrical Interference**—by A. P. Hale—Pub. by Philosophical Library, Inc., 15 East 40th St., New York 16, N. Y. $4.75; 122pp.

The author discusses much of what is known about the causes, effects, and avoidance of interference with radio and television reception. Particularly valuable is a series of photographs of a television screen showing the effects on the picture of different types of interference.

• **Principles of Guided Missile Design: Aerodynamics, Propulsion, Structures**—by E. A. Bonney, M. J. Zucrow, and C. W. Besserer—Pub. by D. Van Nostrand Co., Inc., 120 Alexander St., Princeton, N. J. $10.00; 595pp.

This second volume in the series covers the design fundamentals of missile supersonic aerodynamics, means of propulsion, and structural design. Extensive bibliographies are included to supplement the complete but fundamental coverage of each subject.

• **Proceedings of the 1956 Electronic Components Symposium**—Pub. by Engineering Publishers, GPO Box 1151, New York 1, N. Y. Paper bound, $5.00; Cloth bound, $8.25; 240pp.

Forty-three different papers and 293 illustrations cover a wide variety of subjects such as materials progress, electron tubes, solid states devices, passive components, and include treatment of reliability, theory and applications, instrumentation and measurements.

• **Significance of ASTM Tests for Petroleum Products**—Prepared and published by, and available from, American Society for Testing Materials Headquarters, 1916 Race St., Philadelphia 3, Pa. $2.50; 115pp.

Relatively free of technical terms, the third edition presents various test methods, performance characteristics of specific products, and the significance of the properties of petroleum products in relation to one another.

• **Aircraft Materials and Processes**—by George F. Titterton—Pub. by Pitman Publishing Corp., 2 West 45th St., New York 36, N. Y. $6.00; 398pp.

In the fifth edition emphasis has been placed on the effects of heat from aerodynamic heating and jet engine heating on aircraft materials in order to help the engineer select the most efficient materials. Latest processes, materials, specifications are included.

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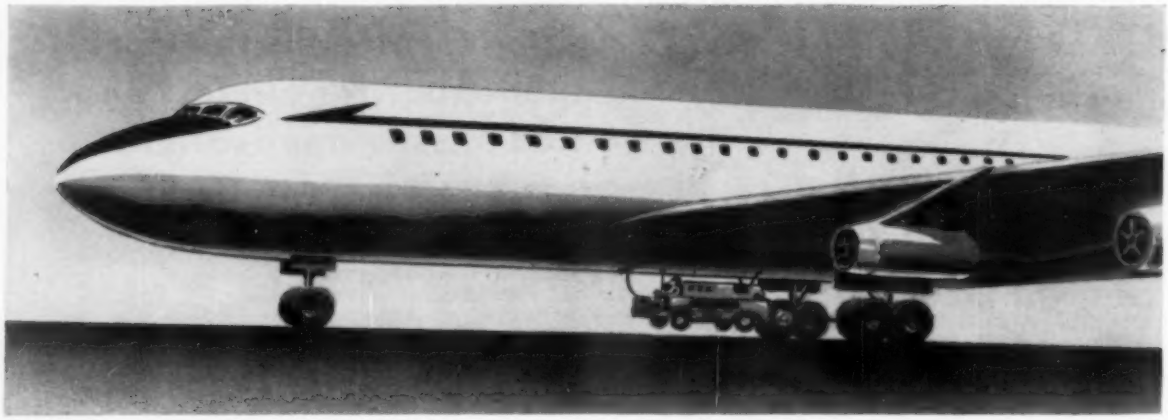


THE MOBILE power unit slung under this 707/DC-8-type commercial jet will provide it with all power needs for ground operation. The unit supplies hydraulic power to taxi the plane under the pilot's control. It also furnishes electrical and pneumatic power.

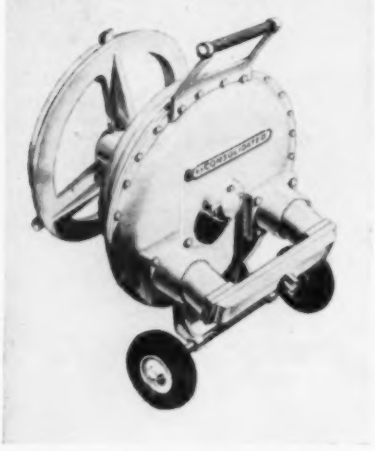
Pilot-Steered Wheel Units Move Planes

By George Christian

A new concept on how to propel commercial jet aircraft while on the ground without using its engines—by attaching hydraulically-driven wheel movers controlled by the pilot—was recently proposed to the Ground Equipment and Maintenance Facilities Subcommittee of the Air Transport Assn. of America meeting at Miami.

The system, which can be handled by one man and uses mostly well-proven components, was proposed by Consolidated Diesel Electric Corporation, manufacturers of a line of ground support equipment for the armed services (AW Dec. 27, 1954, p. 55).

Con Diesel's concept, which is now moving into the prototype production stage, is to have hydraulically-actuated wheel power units attached to one wheel of each main landing gear drive the jet while on the ground. Hydraulic power would come from a low-slung (maximum height is 55 in. to minimize possibility of collision with aircraft structure), mobile power unit which contains an industrial gasoline motor to drive the hydraulic pumps supplying power to the motors driving the units.



TWO OF THESE wheel power units, attached to right and left main wheels, will drive a jet on the ground at 5 mph.

The mobile power unit would also be equipped to supply all of the jet's other power requirements—a.c. and d.c. electric power, high pressure air for such jobs as engine starting, nitrogen for strut inflation. A gas turbine for high volume, low pressure air to run the plane's air conditioning system or other low pressure air needs can easily be supplied as can almost any other ground support equipment.

(The idea of outside hydraulic power to supply motive power to aircraft is not new. Sikorsky uses it to position its large, twin-engine HR2S Marine helicopters (AW Feb. 8, 1954, p. 11). Sikorsky's version consists of two, small hydraulic motors which can be quickly attached to the copter's main wheels to facilitate handling in crowded carrier decks. Power is supplied by an auxiliary power unit).

Con Diesel's mobile power unit will either be slung under the jet's fuselage or driven "in formation" with the plane as it taxis.

Less Noise, Blast & Fuel

The wheel power units, with mobile power, would provide airline users with a solution to several vexing problems at little cost in money, increase of airframe weight or complexity, or increase in ground handling equipment.

Jet noise and blast problems, especially around terminal and passenger loading areas, would be eliminated. So would the appreciable amounts of fuel a four engine jet can swallow during long taxi runs around larger airports such as New York's Idlewild.

The mobile power unit would meet the plane at the end of the active runway where it would be "plugged in" to the jet. The power units would then take over and propel it to, and if necessary, from the passenger loading area.

Since the mobile power unit can substitute for support equipment and a tug, its cost can be written off in the same manner as those ground units. Con Diesel would not estimate a price for the combination, but made an oblique comment to its being "competitive with $10,000 ground handling vehicles."

Another economy deriving from use of the combination is that its entire operation may be performed by one man. The unit can be driven to meet an incoming jet. The WPU's are light enough—about 100 lb. each—to be positioned in the jet's wheels by one man without assistance. He can also connect the pilot's controls and either suspend the vehicle from the plane by self-contained winches or drive it in formation with the plane as it moves to the terminal.

The pilot can taxi his plane to the passenger area at speeds up to 5 mph., then inch it into position through the power supplied by the mobile power in unit to the wheel units. He can pivot the plane by backing one wheel

and advancing the other, or back the ship by reversing both motors.

When unattached to the plane, the mobile power unit can be driven around the airport at speeds up to 30 mph.

Airline Interest

Gerald Rosenberg, Con Diesel's Technical Sales Manager, told AVIATION WEEK that several airlines who have ordered Douglas DC-8s or Boeing 707s have expressed interest in his company's combination. Some have offered to lend piston engine equipment to test the unit when it becomes ready in about eight to twelve weeks, he added.

Airframe manufacturers are also interested, although one did express the opinion that the planes would still be towed around the airfield as usual.

Here is how Con Diesel describes the combination. The mobile power unit will have conventional running gear. The prime mover will be an industrial type gasoline engine with a simple transmission or gear case, driving a hydraulic pump to power the wheel units. It also will power a 90 kva., 400 c. alternator. Space will be provided for a 1,000 amp. d.c. generator, while space is provided on the vehicle's rear deck for a gas turbine compressor.

The wheel units, which are hung on the rear of the vehicle, have a handle on top and wheels underneath to allow the operator to detach them, push them to the jet transport's wheels and attach them easily.

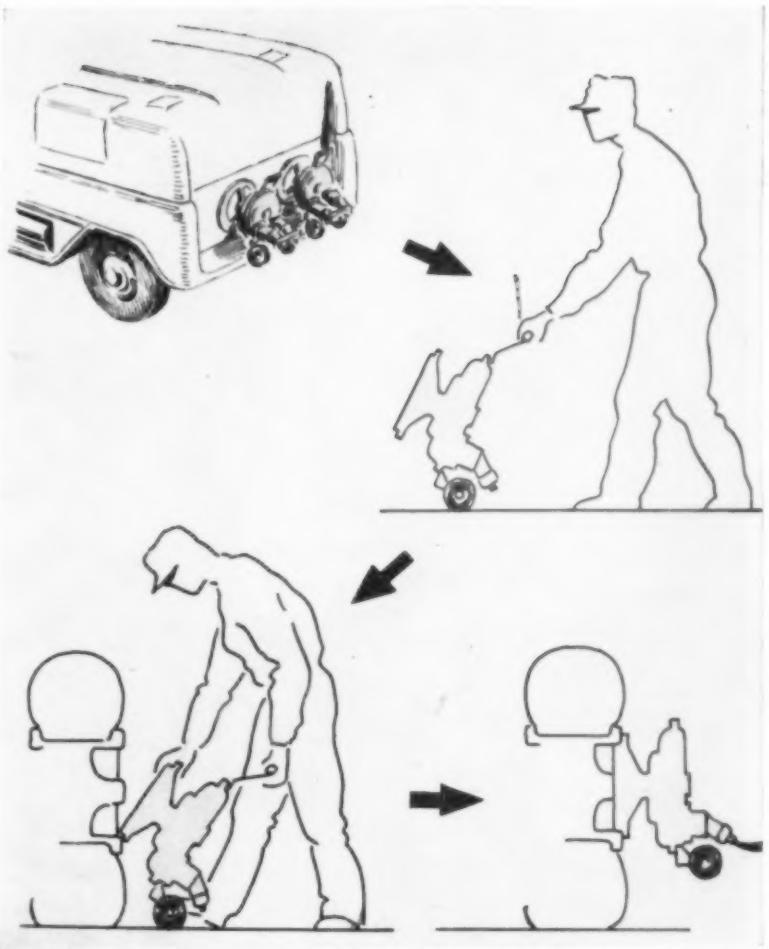
The WPUs will be powered by twin hydraulic motors. They will be so made that attachment to the plane's wheels can be accomplished in 30 seconds. Their design will require little modification to the wheel to make attachment possible.

Con Diesel spokesmen would not reveal what type of technique will be used to take up reaction torque on the wheels. The company said it is studying several approaches.

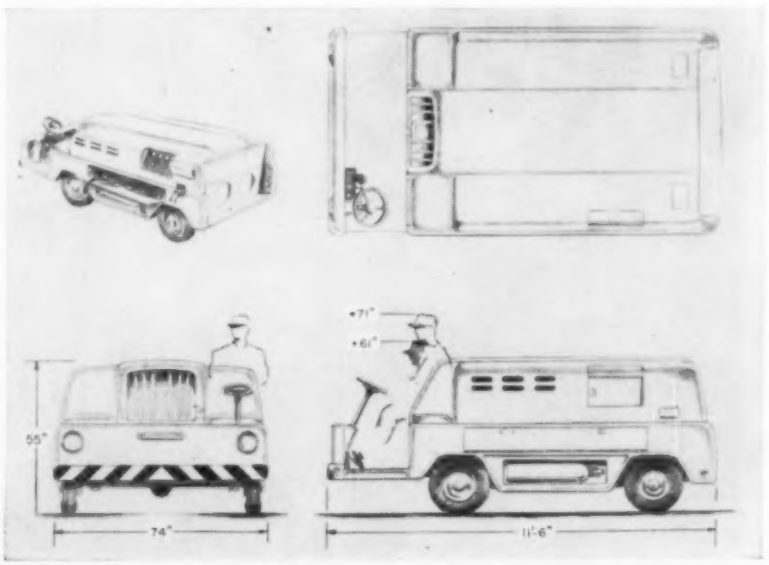
Tension reels will keep the flexible hydraulic lines between vehicle and WPUs taut to prevent them from dragging along the ramp.

Pilot Controls

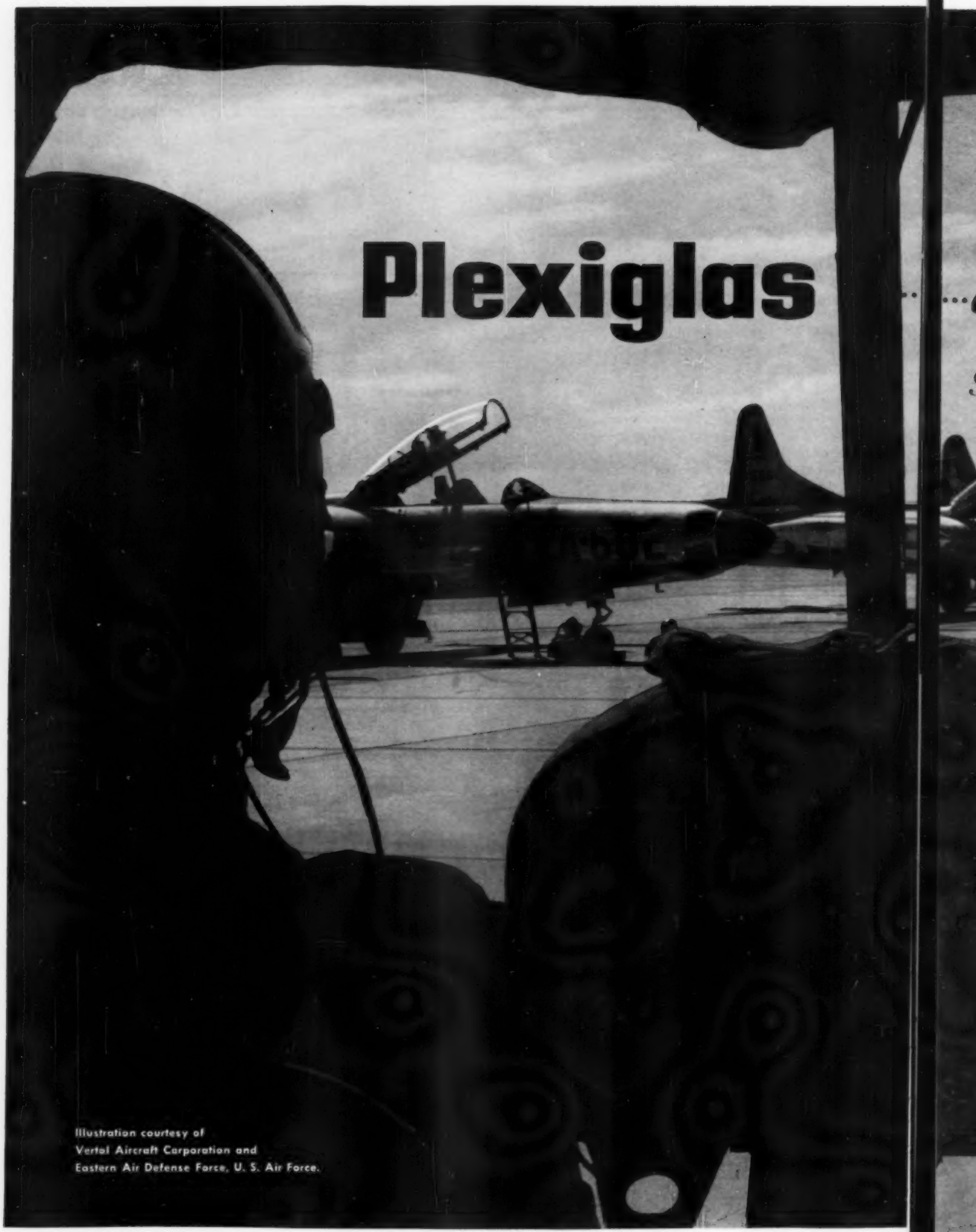
Con Diesel concedes that it has not decided just what controls will be provided to the pilot to taxi his plane. The company favors hydraulic controls because they would be simple and more straightforward. Although the WPUs would probably be driven by a 3,000 psi. hydraulic system, the cockpit controls would be a servo-type system operating at a much lower pressure. Rosenberg suggested that the pilot might keep the controls in the cockpit and lower the hydraulic lines to the ground operator when stopping at the end of



DRAWINGS show how a wheel power unit can be removed from the mobile power unit, wheeled into place and attached to the main landing gear wheel by a single man.



THREE-VIEW sketch show the principal dimensions of the low-silhouette mobile power unit.



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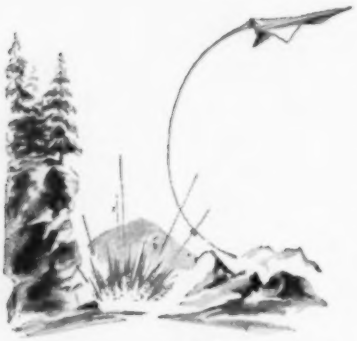

Latest flight techniques now actually enable pilots to toss bombs around corners. No doubt about it, current air operations demand flexibility in tactics and equipment and flexibility is just what Century's duct joints give today's jet planes. No, airplanes can't bend around corners yet but their vital, large-duct plumbing can bend and rotate with these units. That means greater freedom of design, fewer stress points, longer service life for the airplane. Almost no pressure drop either, because Century's advanced design assures unimpeded straight-through air flow.

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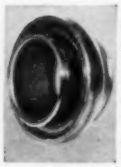

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Lightweight Camera

This new aerial reconnaissance camera features ruggedness—it has repeatedly withstood 40G launching and landing loads—and lightness—it weighs only 20 lb. Yet it incorporates Image Motion Compensation, uses a 9 x 9 in. film and a 6 in. metrogen lens. Made by Hycon Mfg. Co., the unit is designed to be used in all types of aerial platforms, both manned and unmanned, where weight is critical. The maker says that the unit is one-fifth the weight of comparable aerial cameras. The current model, KA-20, was designed for use in missiles and high speed drone aircraft. The first KA-20 was made specifically for installation in the Radioplane RP-71 drone. It was developed under the direction of the Signal Corps Engineering Laboratories, Fort Monmouth, N. J. Hycon's address: 2961 E. Colorado St., Pasadena, Calif.

the runway. These would be quickly connected to the mobile power unit, and the pilot could then proceed to the terminal.

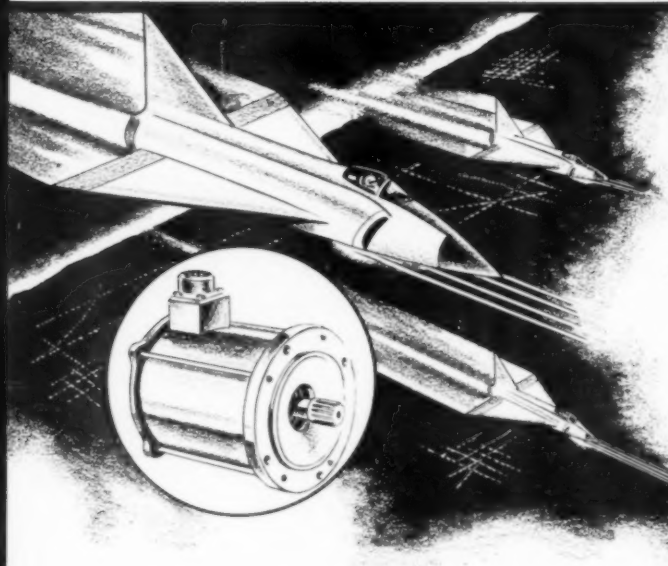
A low amperage electrical control system, regulating the hydraulic system through solenoid-operated valves, could be an alternate controlling method—but the addition of the electrical equipment would add completion too, Con Diesel thinks.

An ideal situation would be for the airframe manufacturers to build into their planes a cockpit control with either hydraulic or electric lines terminating at a quick connect/disconnect terminal mounted at some appropriate place on the lower fuselage. Also, Con Diesel hopes that it will be possible for attachment points to be provided under the fuselage where the mobile power unit may be attached and hoisted to avoid having to drive it in formation with the plane as it taxis.

The manufacturer hopes that these eventualities will come to pass if their concept gains airline acceptance.

Con Diesel has been producing jet servicing equipment, including mobile power units, for the USAF and the

AVIATION PROGRESS with G-E aircraft motors



NEW G-E AIRCRAFT GUN MOTOR DEVELOPS **TWO HP PER POUND** FOR 10 SECONDS!

POWER PLUS HAS BEEN PACKED INTO THIS COMPACT 18 POUND, 400 CYCLE MOTOR WHICH DELIVERS 37 HP FOR A 10 SECOND FIRING INTERVAL. NEWLY DEVELOPED INSULATION SYSTEM PROTECTS AGAINST INTENSE HEAT. DOUBLE ROTOR DESIGN PROVIDES HIGH STARTING TORQUE AND EXCELLENT OPERATING EFFICIENCY – PERMITS UTILIZATION OF SINGLE OR DUAL POWER SOURCE.

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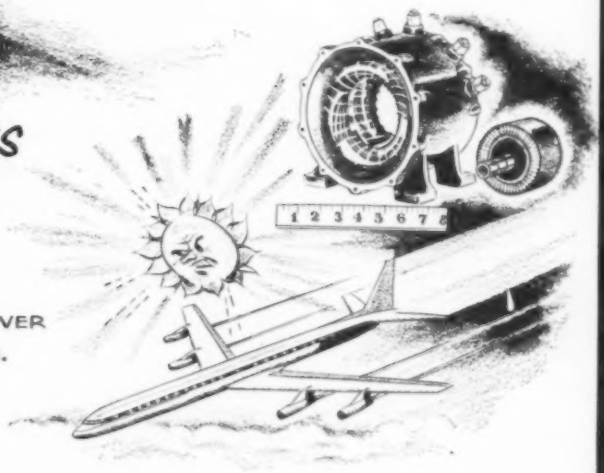

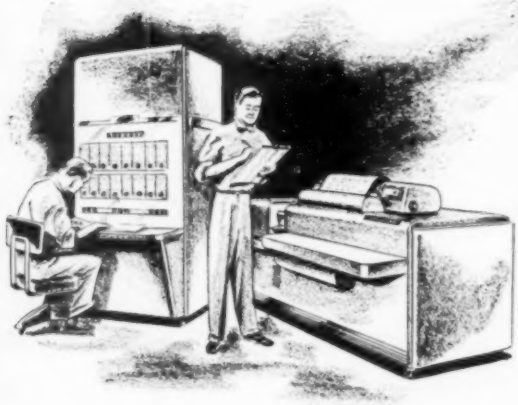

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Two organizations long noted for their contributions to flying have joined hands to achieve another major aviation "first," Cessna's Model 620, now flying. . . . The Cessna Model 620, world pioneer of its type—first pressurized four-engine airplane built for the corporate market—unites several qualities which users of executive aircraft have long desired. Its four Continental Red Seal GSO526-A engines provide four-engine safety, with the important plus of Continental dependability, economy and service backing. It is pressurized for altitudes up to its four-engine service ceiling of 27,500 feet, and air-conditioned for comfort aloft and on the ground. . . . Flights climaxing three years' work on this advanced airplane have fully borne out its builders' highest expectations. The Cessna 620 now takes its place as the latest on the long roster of fine utility aircraft using dependable Continental power.

Continental Motors Corporation

AIRCRAFT ENGINE DIVISION

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Navy for many years. The company has produced over 2,500 units in 14 different configurations.

Studies on the current mobile power unit and WPUs have been in progress for over one year, according to Rosenberg.

Scandinavian Airlines Buys DC-8 Simulator

A contract for a Douglas DC-8 electronic simulator has been received by Link Aviation, Inc. from Scandinavian Airlines System. This is the third DC-8 simulator to be sold by Link. Other purchasers are Douglas Aircraft Co. and United Air Lines. Among the features incorporated in the simulator will be cockpit motion, a visual approach and landing system and simulated weather radar. Link says that the simulator will be delivered to SAS at least a year before the first DC-8 is expected to be put into service, thus giving the airline's crews ample time to familiarize themselves with the plane's cockpit and flying characteristics before facing the actual aircraft.

OFF THE LINE

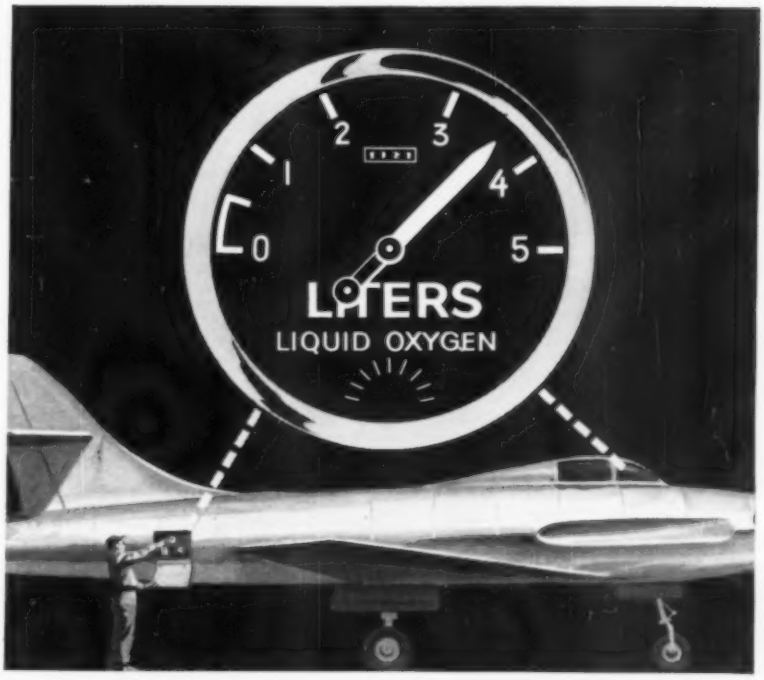
A $159,000 contract for Poro-Klean porous metal, magnetic filters (AW March 26, p. 73) has been awarded to The Cuno Engineering Corporation of Meriden, Conn. by Chance Vought Aircraft for use on its supersonic F8U Crusader.

A new tempering process which results in aluminum alloy hand forgings with very low internal stresses has been developed by the Aluminum Company of America. Immediate advantages are appreciably reducing machining and straightening time which cuts production costs. The new process, designated T65 temper, is based on precisely controlled cold reduction following solution heat treatment.

A new engineering, manufacturing and sales organization dealing in hydraulic controls and circuits has been formed under the name of Dynex, Inc. The company is a development of the Hydraulic Control division of Blackhawk Manufacturing Co. Purpose of Dynex is to give customers quick service in hydraulic matters pertaining to research, new product development, specialized circuit applications, sales engineering and field service. Address: 1500 South Huskego Ave., Milwaukee, Wisc.

A program of compressor modernization has been established by the DeVilbiss Co. under which model 225

PIONEERING is our business



SERVICING LIQUID OXYGEN MADE SAFER AND EASIER BY NEW BENDIX DUAL INDICATION

Bendix capacitance type liquid oxygen quantity gage systems now offer *dual* indication—in the cockpit and at any desired point on the airplane.

Two important advantages are gained when an indication is located near the servicing point:

1. The mechanic can check the liquid oxygen supply in the system quickly and easily from the ground as part of his regular line maintenance.
2. In replenishing the liquid oxygen supply, the serviceman gets a continuous reading *right at the point of servicing*, so that he knows exactly when the converter is filled, rather than having to wait for the liquid oxygen to spill out the vent valve—with the hazards that inevitably accompany such a procedure.

Bendix systems for measuring liquid oxygen levels are completely transistorized to meet critical space and weight limitations. They work with both single- and multiple-converter installations and are adaptable for use in missiles.

For full details, write PIONEER-CENTRAL DIVISION, BENDIX AVIATION CORPORATION, DAVENPORT, IOWA.

West Coast Office: 117 E. Providencia Ave., Burbank, Calif.
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Kaman's Engineering staff has already designed and developed the world's first twin turbine helicopter, the first drone helicopter, the rotochute and the highly successful HOK utility helicopter. It is now hard at work researching ringwing aircraft and pioneering on other highly classified projects.

A Kaman Engineer must be technically qualified, of course, but he must also be able to exercise initiative and think on his feet. Most importantly he must have vision and be able to apply himself to the project assigned him. The reward for his intelligent hard work is a salary commensurate with ability, extremely pleasant working conditions among people with a job to do, and the satisfaction which comes from a job proudly and carefully accomplished in the interest of our National Defense.

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- ☐ Systems Development
- ☐ Structural Design
- ☐ Test & Development
- ☐ Thermodynamics
- ☐ Weights

compressors can be replaced with model 230 units and the 235 and 342 series may be replaced with the new, V-type model 432 compressor. The change-over program can be done at reasonable cost and without excessive compressor downtime.

Gordon Enterprises, North Hollywood, Calif., has been awarded an Air Force contract for 300 electrically-heated, thermostatically-controlled film dryers. The stainless steel units, which will handle 8x10 in. cut film, are being purchased by the USAF for the Navy under a joint procurement program.

Stillman Rubber Co., a large producer of custom molded parts, silicone and synthetic O-rings and hydraulic packings has expanded its Culver City, Calif. production facilities 30% by adding a 8,000 sq. ft., two-story building.

A new plant to manufacture Ethyl anti-knock compounds will be built in the San Francisco Bay area, according to the Ethyl Corp. The facilities will be large enough to serve the growing aviation and automotive needs of the West Coast oil industry.

Lockheed's turboprop Electra will use a new type of aircraft disc brake with sintered metal linings and newly-perfected automatic adjustment according to the brake's manufacturer, the B. F. Goodrich Aviation Products Division. The brakes will feature smooth operation without chatter. Goodrich will also design and make the wheels which will mount 13.50-16, 24-ply rating tubeless tires.

New service, sales and warehousing subsidiary was recently opened in Brussels, Belgium, by The Black & Decker Manufacturing Co. The Towson, Md. firm's new outlet, called Black & Decker (Belgium) S.A., will distribute the complete line of B&D portable electric tools throughout the Belgium-Luxembourg area. This is the seventh foreign subsidiary to be established by the company.

Cabin interiors of Braniff International Airways' DC-7C "El Dorado" aircraft was designed by the airline and Douglas. Motif of the three compartments combines the fiesta spirit of Latin America with the relaxed informality of the Southwest, where Braniff originated. Accent is on tinted leathers, panels inlaid with strips of gold, or sequin-dotted, and plastics in corals, aquas, whites, champagnes and golds. Foam rubber seat cushions are covered with charcoal fabric flecked with silver thread while arm rests and side panels are in coral and graphite

Mobile Generator

This 20 kw., trailer-mounted generator set is being delivered to the Marine Corps for use at radar installations and for auxiliary support as a general purpose utility machine. The manufacturer, Consolidated Diesel Electric Corporation, holds a $1.6-million contract for the generator sets. Shipments are under way. Address: Stamford, Conn.

leather. Planes will seat 60 passengers in de luxe version and 73 in combination de luxe and coach layout.

A mutual sales representation pact has been set up between Flight Research, Inc., Richmond, Va. and Traid Corporation, Sherman Oaks, Calif. Both companies manufacture photographic data recording instruments including all-purpose cameras used in the design and production of weapons systems and for such jobs as missile tracking, radar evaluation, airborne systems and fire control analysis and evaluation. Flight Research will have exclusive sales rights east of the Mississippi, Traid will have the same exclusive coverage in the western half of the U. S.

Crouse-Hinds Co., manufacturers of aviation lighting and airport control tower equipment, has purchased Surveyor Service Co., of Silver Spring, Md. Among products of the latter firm are weather observation systems.

New corporation, Hydrometics, Inc., has been formed by a group of men formerly with Lear, Inc., and more recently with National Water Lift Co., to undertake design studies "beyond the state of the art" of such items as power control components and systems for advanced engines and airframes. The new company's president, James Snodgrass, says that his firm has designed hydraulic actuators which can be used in ambient temperatures of 1,000F and has developed complete aircraft servo control systems. Other officers include: Raymond Kubiak and Joseph Pilolla, vice presidents—engineering, and Walter Karasiewicz, secretary-treasurer. Address: 121 E. Kalamazoo Ave., Kalamazoo, Mich.

Kaman's HOK-1 general utility helicopter, now in volume production, is designed to carry personnel, litter evacuees or cargo internally. Fitted out as a "flying crane" it can carry cargo slung externally. Equipped with a power hoist it can be used for search and rescue operations.

As a rescue vehicle the HOK got its baptism of fire in the disastrous New England floods of August 1955, and came through admirably. Kaman is proud of these mercy missions. Kaman is also proud of the part it is privileged to play in the continuing program of National Defense.

KAMAN

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BLOOMFIELD, CONN.

F4D Skyray . . . Navy's Sunday Punch!

The Navy's F4D Skyray — newest all-weather fleet interceptor — gets its deadly sting from its Westinghouse Aero 13 armament control system.

Visibility good, or zero — when a Navy pilot is searching out enemy targets in a Douglas F4D, a blip on his Aero 13 radarscope shows him where the invading planes are. He selects the appropriate target and locks on, tracking. The Aero 13 computer calculates the proper attack course (at the pilot's option) until the target is in range. Directed by the Aero 13, the weapons are fired at the right instant — another intercept mission is accomplished!

The Aero 13 embodies advanced design for convenience of installation and maintenance, by cylindrical packaging, which is adaptable for the nose of any modern high-speed fighter aircraft. It consists of hinged panels which can be swung outward and downward for quick maintenance.

Each panel section in turn contains removable subassemblies. Complete circuits can be checked with test

U. S. Navy Photo

equipment similar to an ordinary tube tester. Built-in test points in the radar subassemblies provide quick localizing of trouble.

Latest in the Air Arm fire control series, the Aero 13 is a refinement of an earlier Westinghouse development that scored the first blind kill of an enemy aircraft over Korea. It is one more example of creative engineering by Westinghouse – airborne defense systems to keep America free.

For assistance in specific fields of airborne electronics defense systems, contact Westinghouse Electric Corporation, Air Arm Division, Friendship International Airport, Baltimore 27, Md. J-91049

The Aero 13 incorporates the complete radar and computing system in a unique barrel-type package which fits perfectly in the nose of the aircraft. Overhead slide-rail mounting provides easy pull-out for service.

The Air Arm Systems Family

Fighter Armament	Bomber Defense	Flight Control
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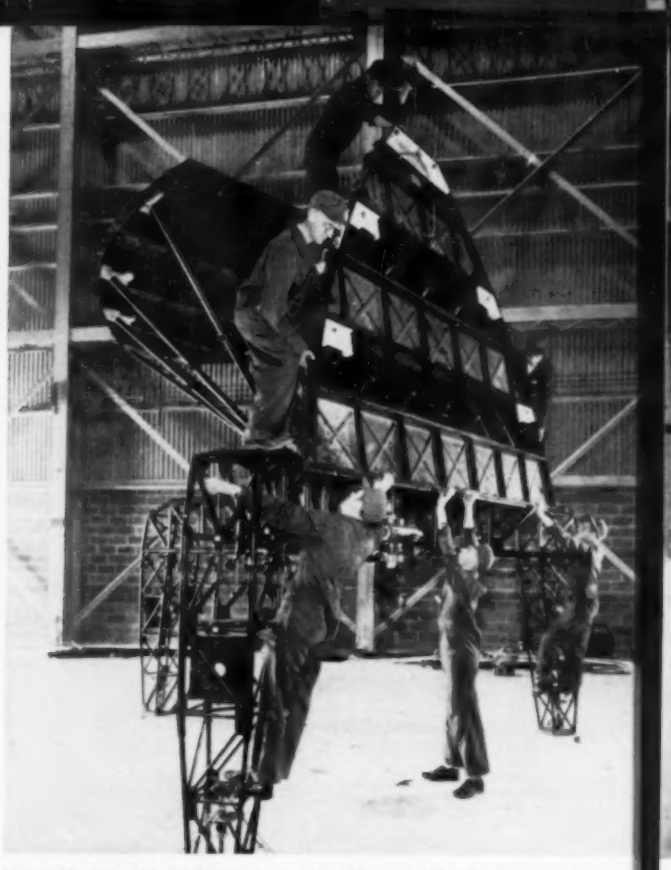


PARABALLOON radar antenna, unpacked from air-lift containers, is quickly assembled. Magnesium tripod-base (right) is first erected.

Radically New Radar Antenna Inflates

By Philip J. Klass

Baltimore—"Paraballoon," a radically different type of ground radar antenna that can be inflated or deflated like a balloon, folded and packed into a few small airlift containers for tactical operations, has been unveiled by Westinghouse Electric Corp.

The new antenna is called "a major break-through" by Maj. Gen. Stuart P. Wright, Commander of the Rome Air Development Center which sponsored the development. The Paraballoon consists of an air-inflated fabric balloon with parabolic contour, one of whose inner surfaces is coated with aluminum particles to reflect radar energy.

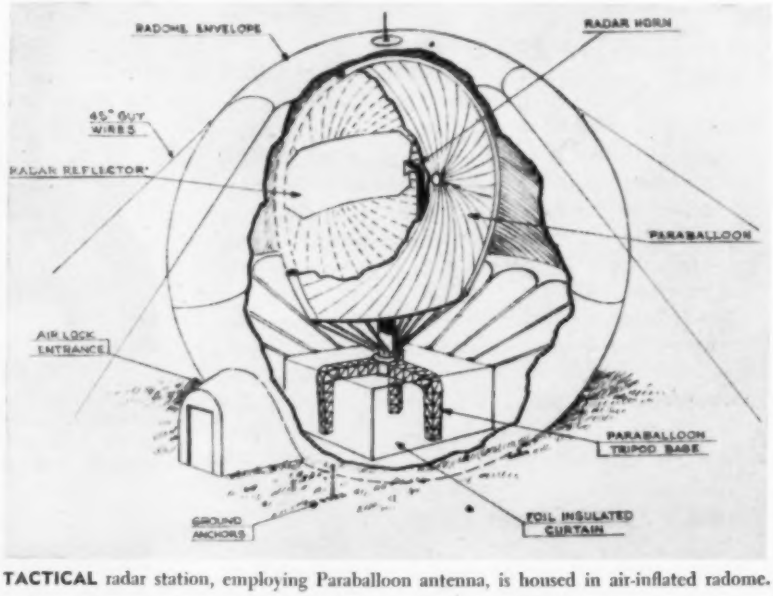
Lighter Weight

A 30-ft. diameter Paraballoon weighs only 1,700 lb. in sharp contrast to the 10,000 lb. weight of its conventional equivalent, and its weight advantage goes up with antenna size. Westinghouse has built 50-ft. Paraballoons and believes the technique can be extended to 120 ft. diameters.

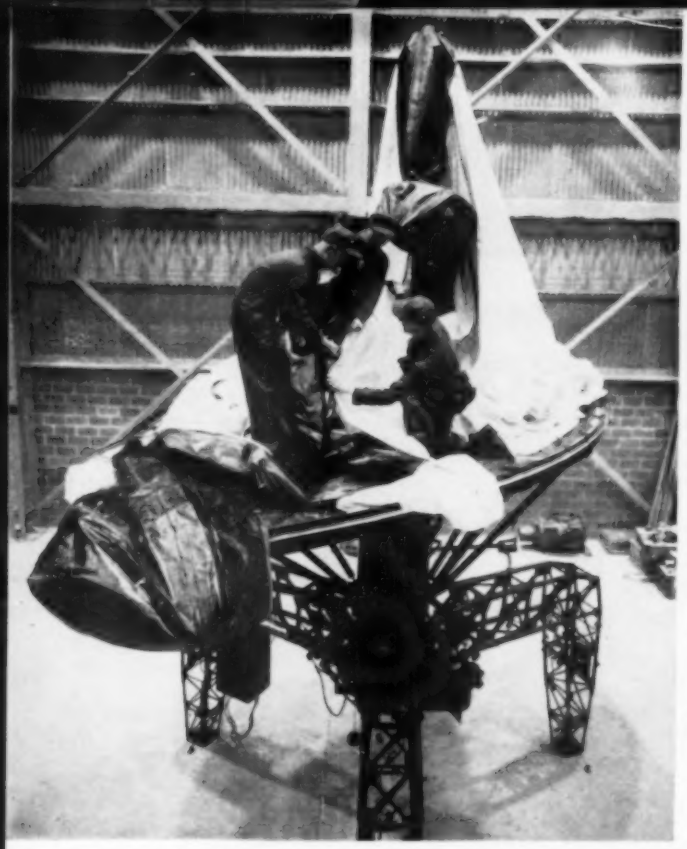
This means that tactical ground radars equipped with Paraballons can use much larger antennas, giving longer range and higher resolution, yet still achieve a major saving in size and weight—an important factor in tactical logistics.

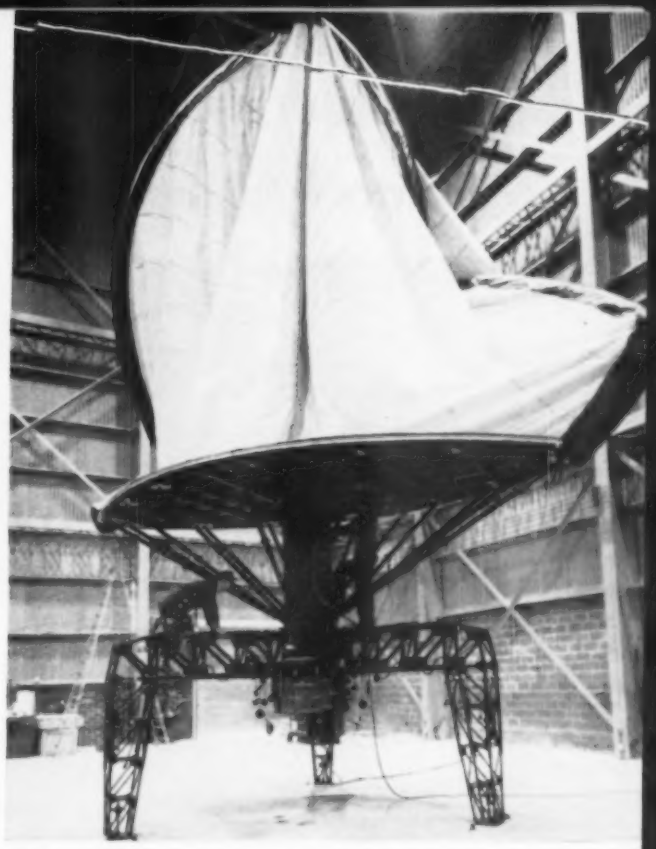
Westinghouse reports that its new antenna can be assembled by eight men in less than an hour, considerably quicker than the assembly time for a conventional antenna. The Paraballoon comes down even faster and can be packed into easily handled container no one of which weighs more than 200 lb.

The Paraballoon is constructed of vinyl-coated fiberglass fabric, contoured during initial fabrication into two



TACTICAL radar station, employing Paraballoon antenna, is housed in air-inflated radome.





FABRIC paraboloids are zipped to structural support member resembling a tire innertube (left). Tube and antenna are then inflated (right).

Like Balloon

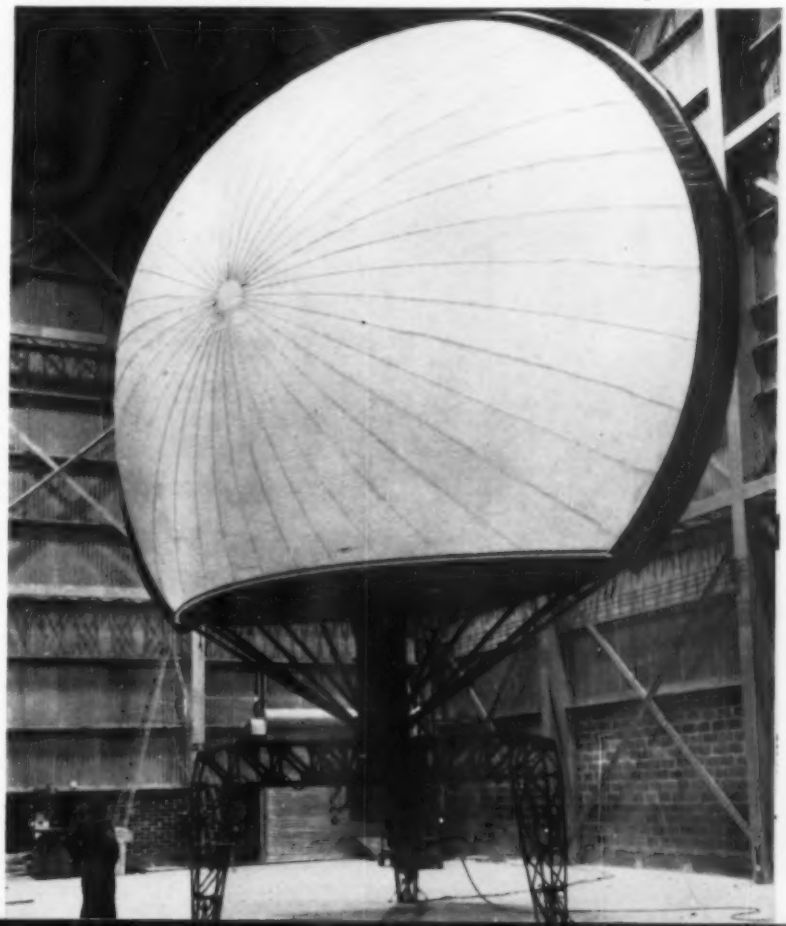
paraboloid-shaped halves. These are joined around their periphery to an air-inflated tube which provides structural stability like a supporting arch. (In the 30-ft antenna, this tube is 16 in. in diameter and is inflated to a pressure of 10 psi.—considerably more than the pressure within the Paraballoon.) The bottom of the Paraballoon is cut off and attached by Zipper-type fasteners to a folding three-legged magnesium pedestal.

A motor-driven blower in the Paraballoon base pumps air from outside into the space between the two halves of the antenna, inflating the paraboloids to their preformed contours. A pressure differential of as little as 0.02 psi. is sufficient for satisfactory operation, Westinghouse says.

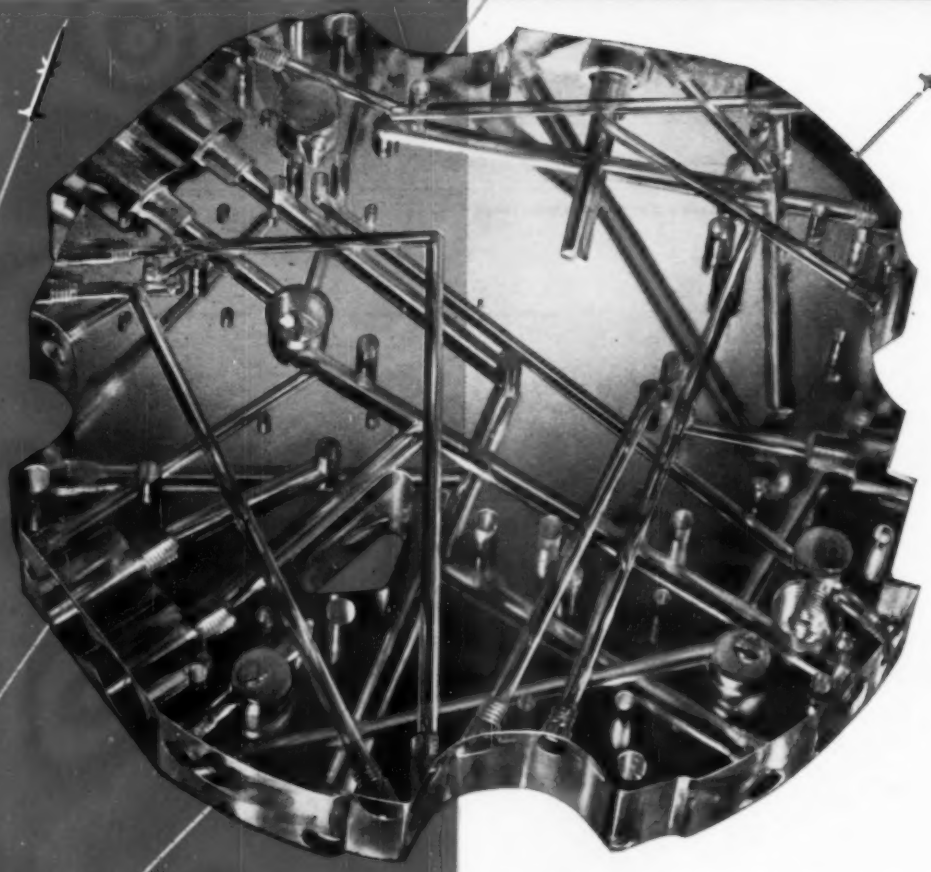
To provide a radar reflecting surface, a thin film of aluminum is deposited by evaporation onto a mylar sheet which is cemented onto the inside of one paraboloid. Where the complete surface of the paraboloid is to serve as a reflecting surface, the fabric has the aluminum deposited on it during its manufacture.

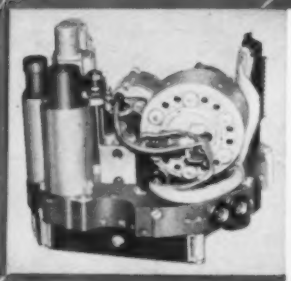
A conventional antenna feed, supported inside the Paraballoon by the pedestal base, bounces radar energy off the aluminized surface through the other half of the Para-

COMPLETED Paraballoon performs better than conventional antenna, weighs far less.



Making it complex... ...for simplicity!





The Terrier Package, developed for Convair and in production at Bendix-Pacific, includes air motors, alternator, hydraulic pump, servo valves, flow limiting valves, air regulators, accumulator, reservoir, filter, cylinders and potentiometers.

Production of components and systems at Bendix-Pacific includes rigorous and thorough testing with specialized equipment. Pictured here is the Terrier Package final assembly shake stand and associated checkout equipment.

This is a transparent model of the magnesium manifolded mounting base for the Convair Terrier Missile hydraulic unit. Note the maze of drilled passages which make for a compact, reliable missile system package. All external interconnected plumbing lines have been eliminated. Components can be readily removed for servicing; the entire system can be tested as a unit and installed in a minimum of time.

The Bendix-Pacific system illustrated at the left uses compressed air to deliver electrical power for the missile, wing actuation through integral servo valves and cylinders, and hydraulic power for the remotely located roll actuator. Eighteen components are mounted on this manifold and interconnected with fifteen feet of "integral plumbing"—a complex production problem with simplicity as the end result.

Bendix-Pacific is equally as proud of its ability to conceive and design as it is of its ability to produce this type of product in volume.

Have you a similar design or production problem? A Bendix-Pacific Sales Engineer is available to discuss it with you.

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balloon. The air-inflated antenna and its supporting structure are so light in weight that a one-quarter horsepower 400 cps. induction motor is sufficient to rotate the 30-ft. antenna at a speed of 6 rpm. This is about one-quarter the size of the motor needed to turn a conventional antenna of the same size.

Better Performance

During the past year Westinghouse has run extensive pattern tests on the Paraballoon mounted atop huge tower on a gimbal system that permitted the antenna to be elevated and depressed. These tests indicate that is performance is somewhat superior to a conventional antenna, according to James W. Currie. Currie is manager of the antenna and microwave components section in Westinghouse's Electronic Division.

This superior performance results from the ability to hold antenna contour dimensions more accurately with Paraballoon type construction than with conventional designs, Currie told AVIATION WEEK with reasonable care, the Paraballoon contour dimensions can be held to within $\frac{1}{8}$ in. over the entire surface of a 30 ft. dish, Currie says.

Equally important, repeated erection and disassembly which often causes conventional antennas to lose their original contour has no measureable effect on the contour of the Paraballoon antenna, Currie says.

Because the Paraballoon needs no struts for structural support, it does not suffer the antenna wave pattern break-up or shadowing encountered in some conventional ground radar antennas, Currie adds.

The new technique is applicable to a wide range of radar frequencies, from L-band through K-band. Westinghouse already is planning to apply the Paraballoon technique to antennas for tropospheric scatter communications and displayed a model of such an antenna at the recent Utica Aeronautical Communications Symposium.

Paraballoon manufacturing costs today are about the same as those for a conventional antenna, but should go down with increased manufacturing experience, Currie believes.

Rugged

Because of the relatively small pressure required to inflate the Paraballoon, its operation is not affected by moderate leakage or puncture. Puncturing the Paraballoon antenna with the equivalent of 50 holes the size of 20 mm. shells has caused no adverse effects, according to Stanley Saulson, Paraballoon project engineer.

The ability of the small blower to keep the Paraballoon from collapsing due to large leakage was demonstrated when this reporter and two Westinghouse engineers entered the center of the antenna through a 20x30 in. access door in the base. Although the door remained open for more than a minute, there was no noticeable deflationary affect on the antenna.

The air-inflated rim that supports the paraboloids is relatively air tight. However, the small air compressor used to initially inflate the rim is operated automatically to replenish any leakage when the rim pressure falls to a pre-set level.

The Paraballoon can withstand wind velocities of 125 mph. when housed inside an air-inflated radome (resembling those used with air defense radars), which is ground-anchored by means of 10 guy wires, Westinghouse says. The units are capable of operating over the temperature range of −65 to 140F.

Construction Details

Each of the two paraboloid sections are constructed from pie-shaped pieces ("gores") of fabric similar to those used in a woman's pleated skirt. The gores are heat-saled together in a temporary "T" joint with excess trimming material in the vertical leg of the "T". The paraboloids are intentionally undersized in this initial operation.

When the two paraboloids are assembled, they are placed on a large

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circular adjusting fixture and inflated so they will take up their natural contour.

Inside the Paraballoon, on a special crane-like stand (see photo, p. 94), workmen compare the contour of the reflecting paraboloid with a master template. To vary the contour a "T" seam may be let out (or taken in).

When the desired contour is obtained, the seams are permanently bonded by means of tape cemented to the joint.

When the contouring process is complete, the paraboloids are attached to the air-inflated supporting rim by means of adjustable fabric curtains which make it possible to compensate for slight out-of-roundness of the air-inflated rim.

Valuable Idea

The air-inflated radar antenna was conceived by Coleman J. Miller, an advisory engineer in Westinghouse's Electronics Division. The Paraballoon idea resulted in Miller receiving two special company awards, totaling $8,000—the largest ever made to a Westinghouse engineer.

The development was carried out as part of a study program for an advanced highly mobile tactical radar for ARDC. Westinghouse credits ARDC for its willingness to back such an unorthodox idea.

ARDC's Joseph Eannarino initially sparked the program and John Barreto was project engineer.

Westinghouse sub-contracted the fabrication of the first experimental Paraballoon antenna to Cornell Aeronautical Laboratory which had pioneered in the field of air-inflated radomes.

Radar Station

The Paraballoon antenna, and its radome (sectionalized into five panels for mobility), are designed to house a complete radar station. The radar equipment is designed to fit under the Paraballoon pedestal, dividing the area under the radome into two sections, one for radar scope observers and the other for maintenance.

In addition, lightweight mobile heating and air conditioning units also are provided.

Westinghouse says that a trained crew of 20 can set up the complete radar station, including radome and Paraballoon antenna, in two hours.

The radome is first erected and inflated by its own blower system. Once this is done a block and tackle can be attached to the crown piece of the radome and used to erect the Paraballoon antenna.

Westinghouse currently is building four 50-foot Paraballoons, two for the USAF and two for the Marine Corps. It also is investigating the possibility of constructing non-paraboloid shaped air-inflated antennas for special applications.

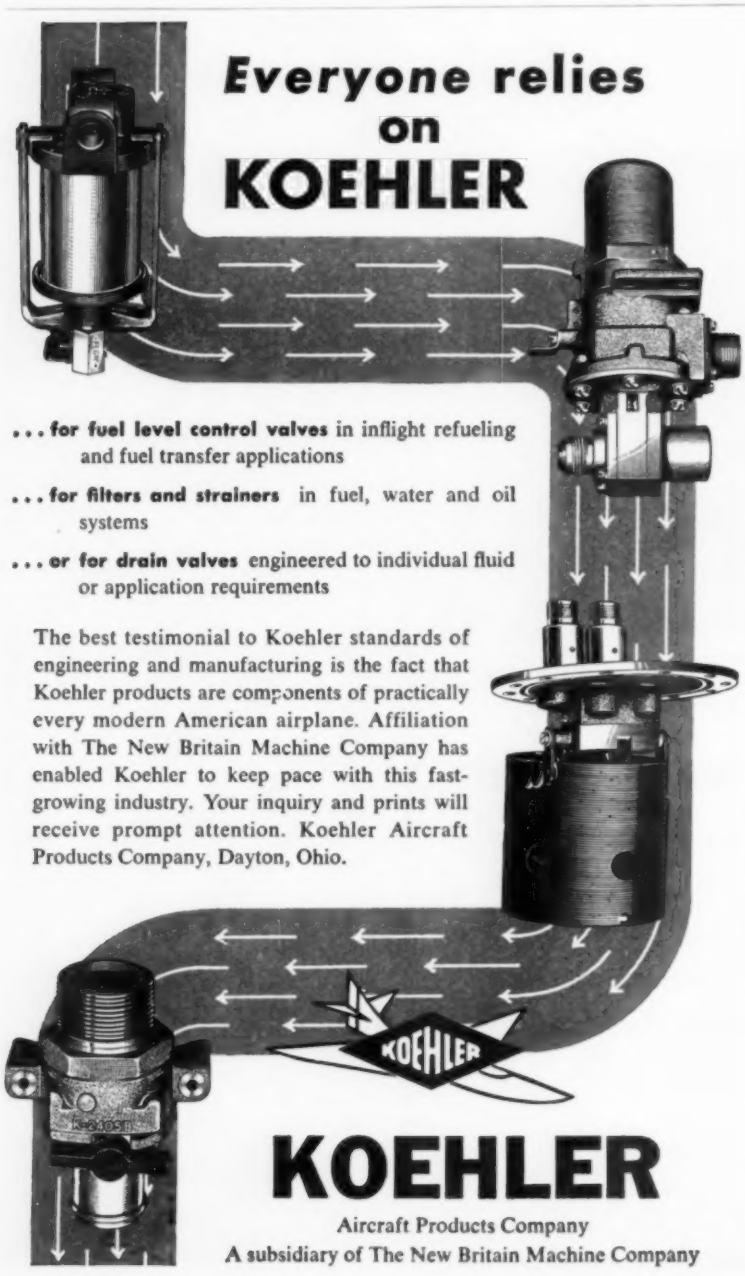
Experience to date indicates that the design of a Paraballoon requires about 20% less mechanical engineering effort than that required for conventional antennas, Currie says. To aid in the design, Westinghouse makes small scale models to determine approximate configuration and dimensions of the fabric gores.

Based on present fabric materials, and year-long tests on an experimental model, Westinghouse believes that the Paraballoon antenna fabric should have a useful life of at least five years.

Mid-Canada Radar Line Will Operate About Jan. 1

Mid-Canada radar warning line along 55th Parallel will go into service about the same time as the Distant Early Warning (DEW) line about Jan. 1, 1957. Mid-Canada line will pin down direction and size of attack after DEW line gives first warning.

Pinetree line, third in system, would track raid.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Rascal the strike from "nowhere"

Bell Aircraft's GAM-63 Rascal is an air-launched guided missile designed to carry out bombardment of strategic military targets—*without the need of bombing runs on the target.*

Rascal is carried by USAF long range bombers and released miles away from its destination, with the bomber well outside the perimeter of local defenses. Then, while Rascal is speeding one way towards the target, the bomber already is headed for its home base in the opposite direction.

In this manner, Rascal could extend the useful life of the nation's bombardment aircraft and eliminate many hazardous operations for the crews of these bombers, thereby fulfilling two important economic and human goals of a strong Air Force.

The rocket-powered Rascal's ability to hit a target while the bomber aircraft is miles away has been demonstrated in a flight test program conducted in conjunction with the Air Research and Development Command.

Bell Aircraft has the weapon system responsibility for Rascal and with the cooperation of its many subcontractors, has developed the electronic, servo and propulsion systems for this air-to-surface missile as well as the airframe, launching, ground handling and training equipment.

The Air Force-Industry team urgently needs scientists and engineers for projects vital to the nation's defense. Opportunities to make important contributions are offered in military or civilian careers.

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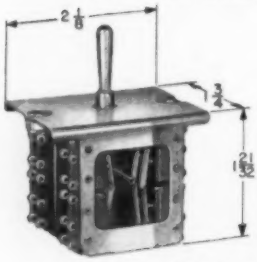


HERE ARE A FEW EXAMPLES

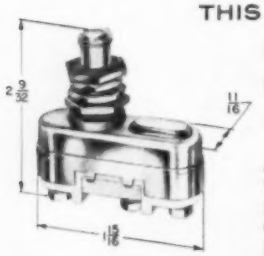
MULTIPLE CIRCUIT TOGGLE SWITCH MEETS PROBLEMS OF SIZE, WEIGHT, AND CAPACITY

Sixteen reliable, small-size MICRO subminiature switches are the components of this Type "AT" toggle switch. The switch was designed by MICRO SWITCH engineers for the control of 16 electrical circuits in a jet fighter.

The switches are single-pole double-throw and the assembly is operated by a single bat handle. Eight of the switches are operated with each direction of the toggle motion.

This entire 16-switch assembly is but 2-25/32" in height, including bat handle. It weighs 3.83 ozs.

(Send for Catalog 75a—"Subminiature Switches")



THIS HIGH TEMPERATURE SWITCH OPERATES RELIABLY FROM −50° TO +1000°F

Aircraft designers have found this switch an extremely dependable component for the increasing number of high temperature aircraft applications. Only laboratory-tested, heat-resistant materials are used in the manufacture of these switches. The switching element is mounted on a ceramic block and protected with a corrosion-resistant monel enclosure. This switch is available with pin plunger and roller plunger actuators, in addition to the panel mounting design shown.

This is a compact, lightweight, reliable precision switch capable of meeting a wide range of applications where the switch is exposed to extremely high temperatures. For example, as a signal switch located on a jet engine afterburner. Operates reliably in temperature ranges from −50°F to +1000°F.

(Send for Catalog 62—"Basic Switches")

PRECISE PERFORMANCE AT SEA LEVEL OR 100,000 FEET ALTITUDE

This is but one of the rigid tests that the MICRO SWITCH "EN" Series switch must meet to assure that it will give reliable, long-life performance in many kinds of aircraft service.

Its precise performance is constant whether ice-coated at −65°F or heated to +180°F. A thousand hours in salt brine spray or 30 days' operation at 104°F and 95% humidity still finds it going strong—and precisely. No chattering of contacts, no loosening of parts occurs during vibration tests of 10 to 500 cycles per second.

The MICRO "EN" is completely sealed, cylindrical in shape. Its performance gives a new concept for airborne switches.

(Send for Data Sheet No. 105)

THERE ARE ALWAYS NEW SWITCHES BEING DEVELOPED AT MICRO SWITCH

Years of experience with aircraft switching problems mean that MICRO SWITCH engineering is rarely faced with an entirely new precision switch problem.

Thus MICRO SWITCH frequently is able to come up quickly with a new switch, a new assembly or a new circuitry design that is a perfect solution to a complex problem.

There are many advanced switch designs being developed at MICRO SWITCH all the time. Some of them may easily turn out to be the switch you need.

It will cost you nothing to consult with MICRO SWITCH engineering personnel. If necessary we can develop an entirely new switch or switch assembly. Specialists are located at MICRO SWITCH branch offices in key cities. Call the one nearest you today.

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Expansions, Changes In Avionics Industry

Bendix Aviation Corp. has purchased a 40% interest in Computing Devices of Canada Ltd., Ottawa. CDC obtains sales and licensing rights to many Bendix avionics products and will make available its own computer developments to Bendix under the purchase agreement. Bendix already owns 70% interest in Aviation Electric Ltd., Montreal, with which it has similar sales-licensing arrangement on its automatic flight control, aviation instruments and electrical systems.

Other recent changes, expansions and mergers in the industry include:

• **General Electric's Defense Electronics Division** has merged its former Naval Ordnance and its Special Defense Projects departments into a single new department to be called Missile and Ordnance Systems Dept. George F. Metcalf, former general manager of Special Defense Projects, heads the new department.

• **Wheeler Laboratories, Inc.,** Great Neck, N. Y. has started construction on a second laboratory in Smithtown, N. Y. The new 11,000 sq. ft. Long Island facility will include a 1,000 foot antenna range and will house 25 engineers and supporting personnel.

• **Sprague Electric Co.,** North Adams, Mass., has purchased controlling interest in an Italian capacitor manufacturer named CREAS, located in Milan. New acquisition will enable Sprague to enter European and Near-East markets previously closed by import restrictions and dollar shortages.

• **Bendix Radio** has opened its new $15 million Advanced Engineering Center in Baltimore, providing 100,000 sq. ft. of air conditioned space for its avionics R & D activities.

• **Topp Industries, Inc.,** Los Angeles, will acquire assets of Heli-Coil Corp., Danbury, Conn., maker of threaded inserts.

• **International Business Machines Corp.** will build a new research center in Yorktown, N. Y., 38 miles north of New York City. New facility will house approximately 1,600 scientists, administrative and supporting personnel.

• **Cook Electric Co.** will open its new Technological Center this month in Morton Grove, Ill., a suburb of Chicago. Cook Research Laboratories and Inland Testing Laboratories will occupy the 158,000 sq. ft. facility which is expected to be staffed by more than 1,000 people.

BLASTING OFF...TO WHAT CEILING?

The security wraps still enfold the answers to such questions. However, Leland did supply the "answer" to the power problems of the Martin Matador with the SE 24-1, 2250 VA Inverter. This is just one example of the proven design and production capability of Leland's Aircraft Products Division; among the other power products developed and produced are alternators, motors, actuators, AC and DC generators.

Power supplies are our business. Therefore, if you have *any* new power equipment problems because of higher altitudes, higher speeds, special lubrication, special cooling, or other unusual environmental conditions, forward all details to our Aircraft Products Sales Department. They will completely analyze your specifications and then develop a thorough engineering proposal to meet them. Why not try us, today?

DESIGN ENGINEERS. If you would like a position with a group that is really performing in this growing field, one which recognizes and rewards personal contributions, then contact immediately Mr. J. E. Mulheim, Chief Engineer.

By-the-way, make a note to stop off and see us at the Aircraft Electrical Society's show in L. A.

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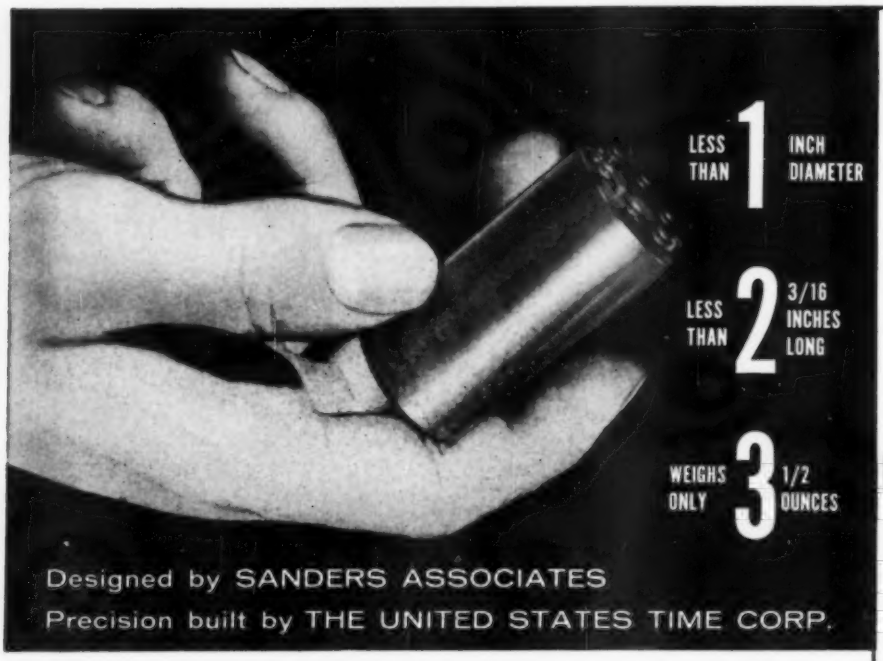
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MOTOR: 26V, 400CPS, 2ø

RUN UP TIME: 15 Seconds

PICKOFF OUTPUT: 5.6V, 400CPS

RESOLUTION: 0.004°/sec.

AC NULL: 10 to 40 MV

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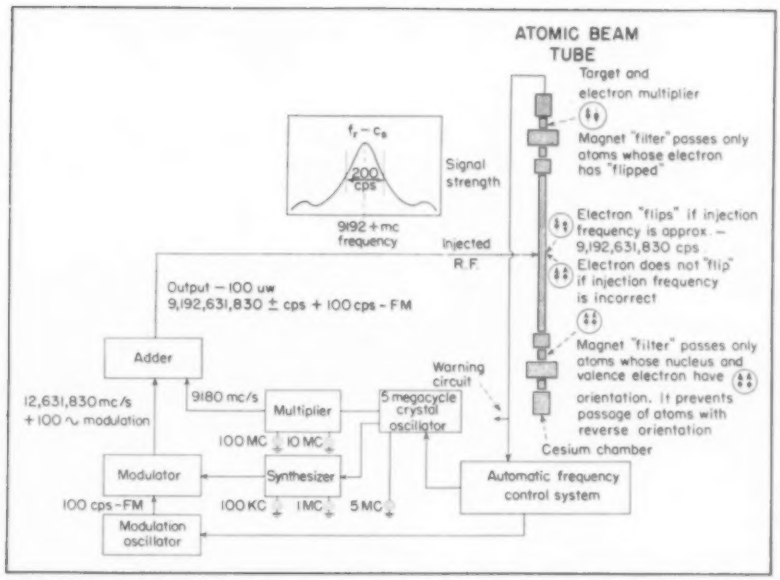
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Electron "flips" if injection frequency is approx. — 9,192,631,830 cps
Electron does not "flip" if injection frequency is incorrect
Magnet "filter" passes only atoms whose nucleus and valence electron have orientation. It prevents passage of atoms with reverse orientation
Cesium chamber
Signal strength
200 cps
9192 + mc frequency
Injected R.F.
Output — 100 uw
9,192,631,830 ± cps + 100 cps - FM
Adder
12,631,830 mc/s + 100 ∿ modulation
9180 mc/s
Multiplier
Warning circuit
5 megacycle crystal oscillator
100 MC
10 MC
Modulator
Synthesizer
Automatic frequency control system
100 cps - FM
100 KC
1 MC
5 MC
Modulation oscillator

BLOCK DIAGRAM of Atomichron showing principles of operation. Atomic beam tube in cabinet (right). Unit soon will be available in 60-lb. airborne model with accuracy equivalent to clock that loses three seconds in 100 years.

Precise Atomic Navigation Unit Developed

The "Atomichron," an atomic-resonance type frequency standard accurate to one part in a billion and stable within five parts in 10 billion, will soon be available in a 60-pound airborne model with comparable accuracy. This accuracy is equivalent to a clock that "loses" only three seconds every 100 years.

Developed by The National Co., Malden, Mass., the airborne unit may find use in the Navarho long-distance navigation system to provide distance-to-station information. (Distance is obtained by comparing the phase of the signal received from the ground transmitter with the phase of the airborne frequency reference [AW April 26, 1954, p. 52].)

National recently demonstrated two of its larger production model Atomichrons which, although operating independently, maintained identical frequencies to within one part in 100 million. All three military services have purchased these units and Rome Air Development Center is using one in connection with its Navarho ground station.

Atomic Reference

Whereas conventional frequency standards must rely solely upon the stability of their quartz crystals, the Atomichron uses a crystal oscillator whose frequency is continuously monitored and synchronized to the resonant frequency of the cesium atom.

The use of this principle to govern the period of an oscillator was first suggested by Professor I. I. Rabi of Columbia University in 1940. Dr. J. R. Zacharias, one of Rabi's former co-workers and now professor of physics at the Massachusetts Institute of Technology, converted the idea into a working laboratory model.

While this demonstrated basic feasibility, a number of practical design problems remained to be solved—such as eliminating the need for continual pumping to maintain the required vacuum in the atomic beam tube. Zacharias interested National in taking over the development and worked with them as a consultant. Present production models sell for around $50,000, but the price should come down with increased sales.

How It Operates

Although presently available Atomichrons produce output signals at frequencies of 0.1, 1, 5, 10 and 100 mc., almost any frequency is possible because it is generated from a crystal oscillator. Oscillator frequency in turn is controlled from an atomic beam tube by a closed-loop servo system.

The atomic beam tube makes use of the fact that the outer (valence) electron of an atom behaves much like a magnet in the presence of the magnetic field set up by the nucleus of the atom. The valence electron may align itself with the nucleus in either of two "polarities," shown schematically by two arrows whose heads point in the same or opposite directions. (See sketch, above.)

A reservoir of cesium chloride is placed in one end of a long evacuated tube and heated. This causes cesium atoms to drift away from the pool at approximately the velocity of sound. A magnetic field set up near the cesium chamber acts as a filter to effectively block atoms whose valence electron and nucleus have opposite alignment polarities and pass only those with the same polarity. (Arrow heads in same direction.)

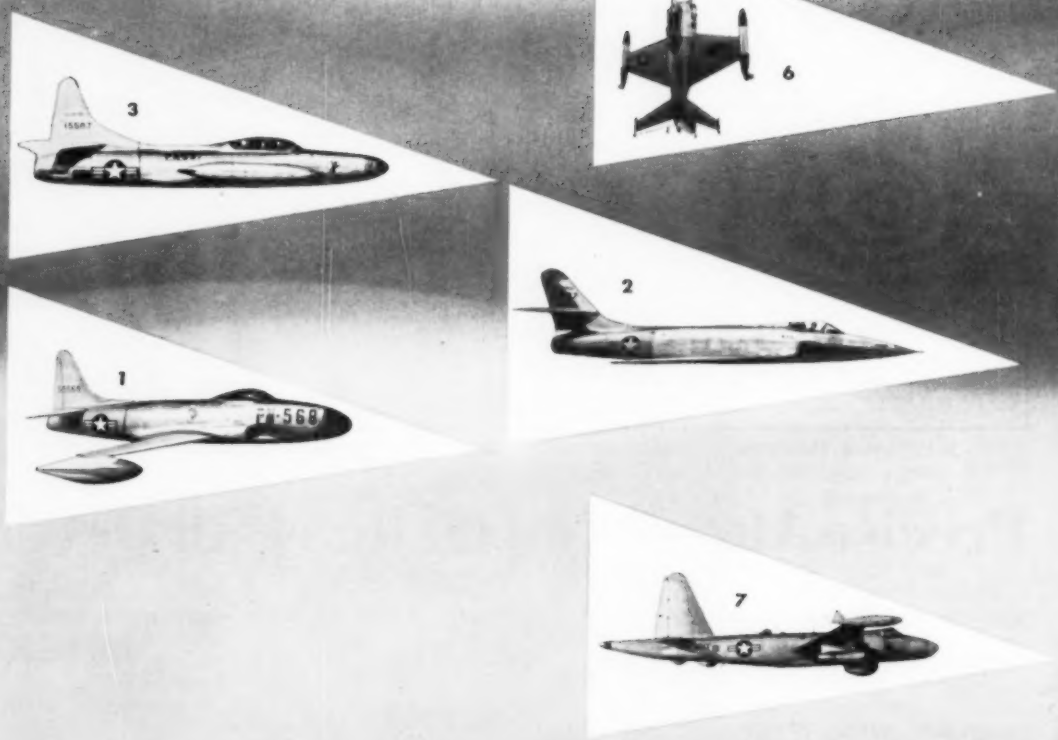
Crystal Oscillator

These cesium atoms then enter a chamber where they are excited with radio frequency energy generated by the crystal oscillator. If the frequency of this RF energy is approximately equal to the atomic resonance frequency of cesium (9,192,631,830 cps.), the valence electron "flips," or changes its polarity relative to the nucleus. If the RF energy injected is not the correct frequency, the electron does not change its energy state.

The cesium atoms continue up the tube to another magnetic field which passes only those atoms whose electrons have flipped, deflecting those that did not flip.

The cesium atoms that get past the second magnetic filter strike a target, become ionized, and are attracted to the cathode of an electron multiplier which amplifies the cesium input current a million-fold.

Any variation of crystal oscillator frequency from the desired value reduces the number of cesium atoms whose



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Sleek aerodynamic beauty, time-tested structural stamina, unique high-performance capabilities and exceptional economy of operation and maintenance are but a few of the LOCKHEED ELECTRA's points of superiority. Its mighty Allison propjet engines, combining jet thrust with proven propeller dependability, enable it to whisk passengers into and out of existing air terminals which now handle nearly 98% of total U. S. air passenger traffic.

The new LOCKHEED ELECTRA's high speed, swift climbing ability and king-size fuel reserves insure greater schedule regularity and reliability—because the ELECTRA can depart on time and fly, undaunted, above or around bad weather. And its spacious cabin-compartments are so restfully quiet, so vibration-free and comfortable, you'll be amazed to discover you're traveling at 7-mile-a-minute speeds.

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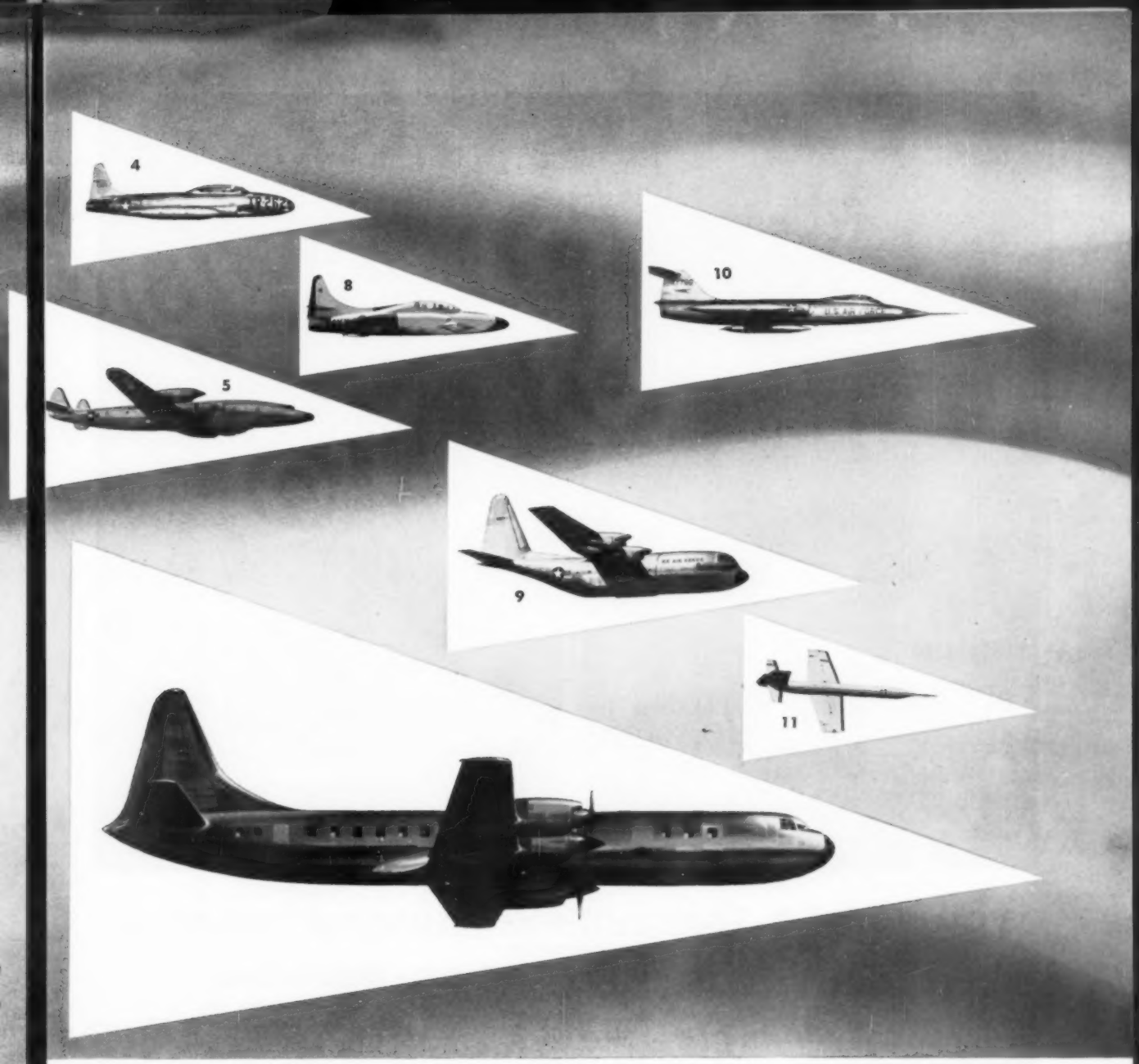
Now in production, the LOCKHEED ELECTRA starting in 1959 will go into service for American, Braniff, Eastern, KLM-Royal Dutch, National, Western and other leading domestic and foreign airlines—extending Lockheed's jet-powered leadership around the world.



ELECTRA

JET L-1000 Turbojet Engine, designed and built by Lockheed in 1941 . . . incorporated many years-ahead features now widely used in present-day jet engines.

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2. JET F-90 Penetration Fighter, first U. S. aircraft to dive through sound barrier routinely—proving supersonic flight not awesome as pilots then thought.

3. JET F-94 Starfire, first of the almost-automatic all-weather jet interceptors—pioneered application of modern electronic equipment in jet aircraft.

4. JET T-33/TV-2 Trainer—world's first successful jet trainer, which gave America its vitally needed backlog of military jet pilots in record-breaking time.

5. PROPJET R7V-2/C-121F Super Constellation—world's fastest propeller-driven transport developing valuable new data for U. S. on high-speed prop-flight.

6. PROPJET XFV-1 Vertical Takeoff Fighter with 2 jet turbine engines and contrarotating props—expedited valuable VTO flight research/development.

7. JET-ASSISTED P2V-7 Neptune—7th in a hardy line of far-ranging U. S. Navy patrol planes, equipped with jet pods to increase attack and evasion capabilities.

8. JET T2V-1 SeaStar Trainer—"World's Safest," first production plane utilizing Boundary Layer Control for slow, safe landings and takeoffs on USN carriers.

9. PROPJET C-130 Hercules—the versatile new go-anywhere, haul-anything "strongman" of the USAF that led America into a new era of swift, low-cost movement of heavy cargo.

10. JET F-104 Starfighter—World's Fastest Jet Fighter . . . "America's Missile With a Man in It," capable of overtaking and destroying any aircraft.

11. RAMJET X-7 Missile, designed and built by Lockheed's Missile Systems Division, is one of a family of supersonic vehicles testing and developing air-breathing ramjet engines.

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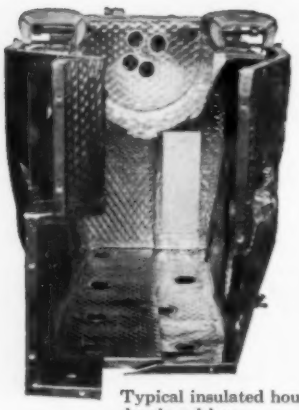

Typical insulated housing developed by Johns-Manville for vital aircraft component.

In the *flying furnace* that is today's jet aircraft—or missile—components must still deliver maximum performance. That's why so many manufacturers of actuators, starters, pumps and electrical equipment are turning to insulated housings as developed by Johns-Manville. These housings are tailor-made for each component design. They fit snugly and form a continuous barrier against the scorching temperatures encountered at supersonic speeds.

Carefully fabricated of high-heat-resistant alloys, Johns-Manville housings are insulated with Thermoflex® refractory fiber felt. They are light in weight yet possess unusual structural strength and rigidity.

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electrons are flipped by the injected RF energy. This in turn reduces the number of atoms that get past the second magnetic field and are able to strike the target, in turn reducing the output signal from the electron multiplier.

Control Sense

The electron multiplier signal by itself merely shows that the oscillator has departed from cesium's atomic resonance frequency, but fails to indicate in which direction. To provide this control "sense", the RF signal injected into the atomic beam tube is phase-modulated at 100 cps.

The frequency of the master crystal oscillator (operating at 5 mc.) which generates the Atomichron output signal as well as the RF injected in the atomic beam tube is controlled by a motor-driven variable capacitor. One phase of this motor is energized from the amplified output of the atomic beam tube electron multiplier, while the other phase is excited from the 100 cps. modulation oscillator.

By comparing the relative phase of the atomic beam tube signal with that of the modulation oscillator, the motor determines whether the master crystal oscillator frequency needs to be increased or decreased and thus the direction in which to drive the variable capacitor.

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Well within MIL-E-5400 for general performance, MIL-T-5422C for environment and MIL-I-6181B for interference, this TI-built system has been designed for a 2000-hr maintenance cycle and an exceptionally long service life. Signal response is instantaneous without need for warmup. There is negligible power drain on standby and negligible heat dissipation while in use. The system takes power directly from a 28 Vdc line and uses less than 6 watts per station.

This is one example of Texas Instruments *systems engineering* now being applied to audio, radio, radar, sonar, infrared, and other systems for communications, navigation, search, fire control, and missile control. Continuing progress over a quarter century has resulted in over a third of a million sq ft of engineering and manufacturing facilities — soon to be doubled — located in an excellent dispersal area.

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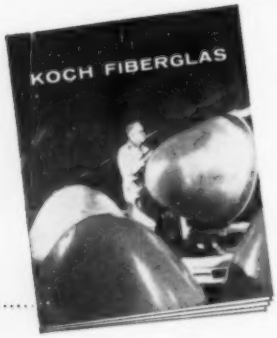

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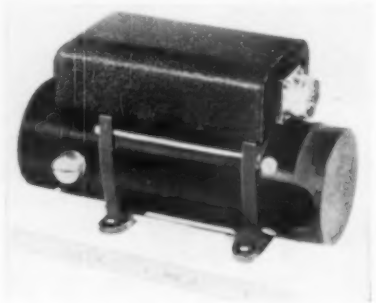
ferent mountings. Types 1N588 and 1N589 have axial leads; types 1N590 and 1N591 have stud mounting, either anode or cathode, for maximum heat dissipation. Bulletins DL-S 649, 650 give full application data. Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, Texas.

• **Miniature trimming pot,** Type G-525, operates over temperature range of −55C to 125C, comes in resistances of 100 to 50,000 ohms, with resolution of 0.2 to 2% and linearity

of 1%. Unit measures 1¼x¼x⅜ in., weighs ¼ oz., comes with wire leads, solder terminals or plug-in terminals. Aero Electronics Corp., 2311 West Burbank Blvd., Burbank, Calif.

• **Miniature regulated inverter,** operates from 28 v.d.c., delivers 115 v., 400 cps, two or three phase, 20 to 40 watts. Complete unit, including radio noise filter, weighs 3¾ lb. Voltage and fre-



quency regulation is 5% over all conditions of load, for input voltages of 24 to 30 v., and over temperature range of −55C to 71C. John Oster Manufacturing Co., Avionic Division, Racine, Wis.

• **Silicon diodes,** solid-state diffused junction Types CK840 through CK845, now available in production quantities with peak inverse voltage ratings of 100 to 600 volts in steps of 100 v., reverse current of 0.2 ma. and forward current of 350 ma. maximum. Raytheon Manufacturing Co., 55 Chapel St., Newton 58, Mass.

• **16,000-Volt silicon diodes,** for operation over temperature range of −55C to 150C, are now available in production quantities. Standard rat-

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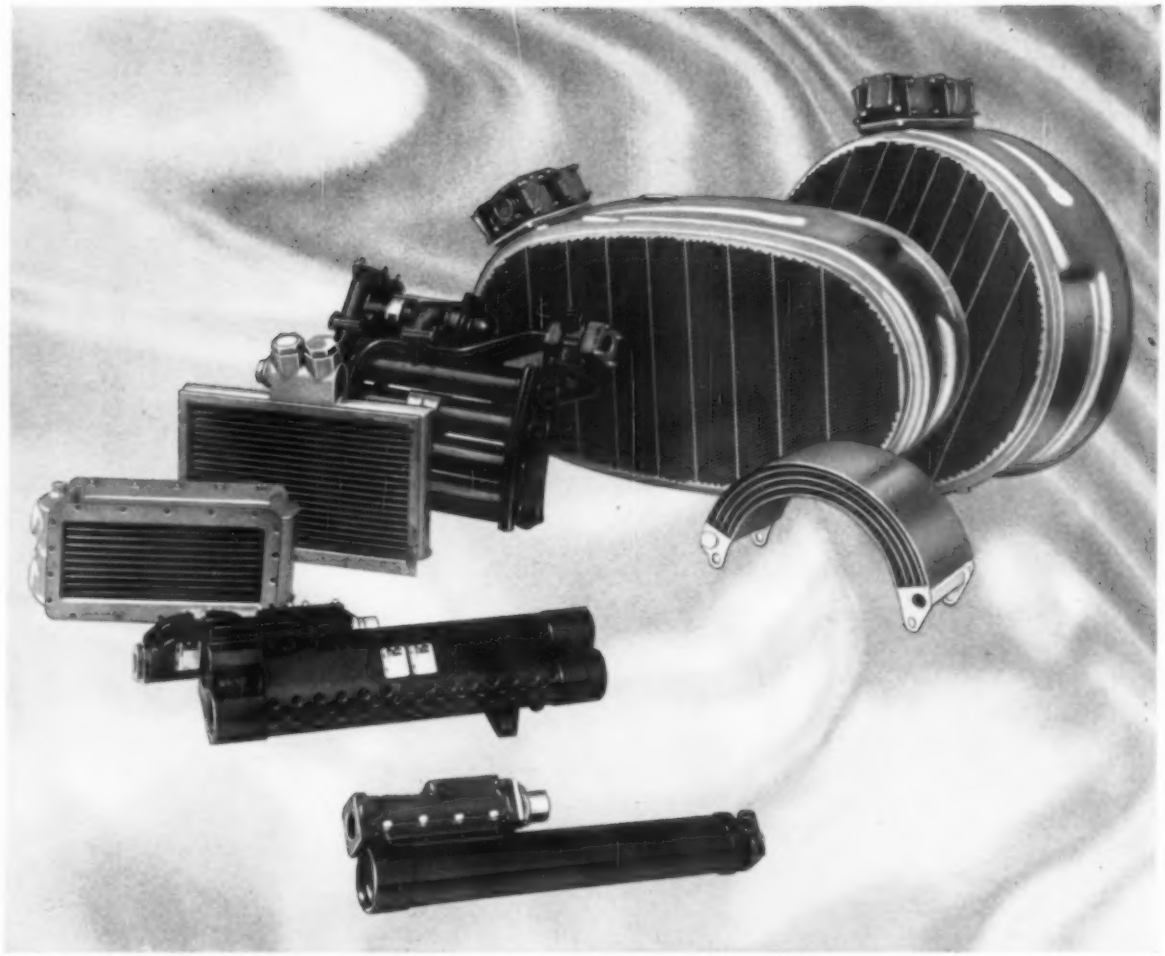

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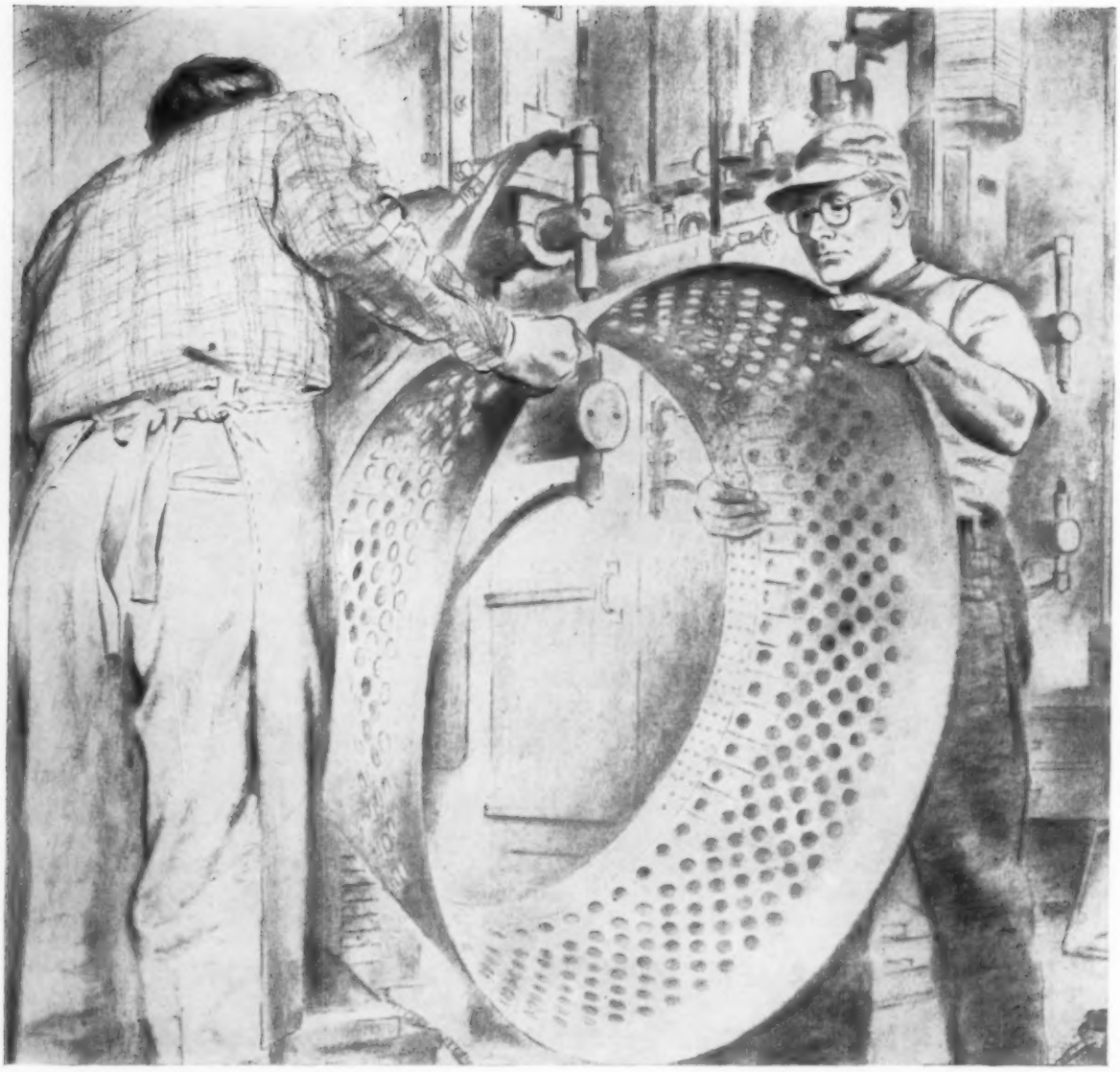

Solar builds titanium assemblies for six major jet engines

ONE OF THE LARGEST users of titanium for aviation purposes, Solar is accumulating invaluable experience with this important metal and its alloys. Assemblies for six turbojet power plants and numerous detail parts are now in production. In addition, Solar development projects involving titanium range over many other vital aircraft applications.

Solar's ability to tame titanium is an example of the company's broad skills. These include the manufacture of both fuselage and propulsion components for guided missiles and high performance aircraft. They also include the design of new types of airborne controls and of intricate ducting systems, the development of protective coatings and all-metal honeycomb structures, and the production of gas turbine engines for many aeronautic uses.

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ings range from 600 v. at 100 ma. half-wave to 16,000 v. peak inverse voltage at 45 ma. Bulletin SR-139A gives application data. International Rectifier Corp., El Segundo, Calif.

Laboratory Equipment

• **Broadband spectrum analyzer,** Model L701A, permits operation over frequency range of 950 to 16,000 mc. with single head. Detailed specifications are available upon request. Electronics and X-Ray Div., F-R Machine Works, Inc., Woodside, N. Y.

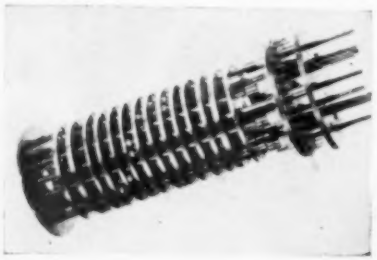
• **Waveform generator,** Model 500, transistorized, battery powered tester, provides clipped-sawtooth and rectangular waveform output with variable repetition rate of 10 cps to 50 kc. Square wave output is available from 5 cps to 25 kc. By changing one

capacitor, repetition rates can be reduced to one every five seconds. Rectangular wave shape is continuously variable in pulse width from 5 to more than 200 microseconds. Cubic Corp., San Diego, Calif.

• **Transistor circuit power supply,** Model T-50-1.5, operates from 115 v., 60 cps., delivers 0 to 50 v. d.c. in three ranges. Ripple is 50 mv. maximum, and regulation is 1% for line voltage variations between 105 to 125. Sorensen & Co., Inc., 375 Fairfield Ave., Stamford, Conn.

Microwave Devices

• **Precision delay line,** magnetostrictive type, generates spaced impulses from a single pulse. These are fed into a crystal matrix which is suitably biased to provide desired pulse code. Fifteen pickup coils, positioned by micrometic screws, result in pulses whose position in time is stable to within 0.05 microseconds. Delay line is hermetically sealed, weighs less than 1.5 lb.



Number of models with different time delay intervals are available. Deltime, Inc., 608 Fayette Ave., Mamaroneck, N. Y.

• **Tape resistor type dissipative cards** for stripline or waveguides have a thickness of only 0.008 in., permitting use at very high frequencies. Resistors can be cut with scissors into any desired shape for proper matching. Type HF-1 resistive strip comes in standard dimensions of 1x3 in., in resistance values of 50, 100 and 200 ohms/-square, with other values available on special order. Hansen Electronics Co., 7117 Santa Monica Blvd., Los Angeles 46, Calif.

• **X-band ferrite isolator,** resonant absorption type rated for 100 kw. is available in four models which cover frequency band of 8.5 to 9.6 kmc. Unit provides 10 db. minimum isolation, 0.5 db. maximum insertion loss, and has input VSWR of less than 1.10.

Airtron, Inc., Dept. B, 1103 West Elizabeth Ave., Linden, N. J.

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EDO AND ELECTRONICS

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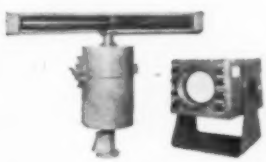
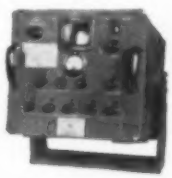


EDO RADAR



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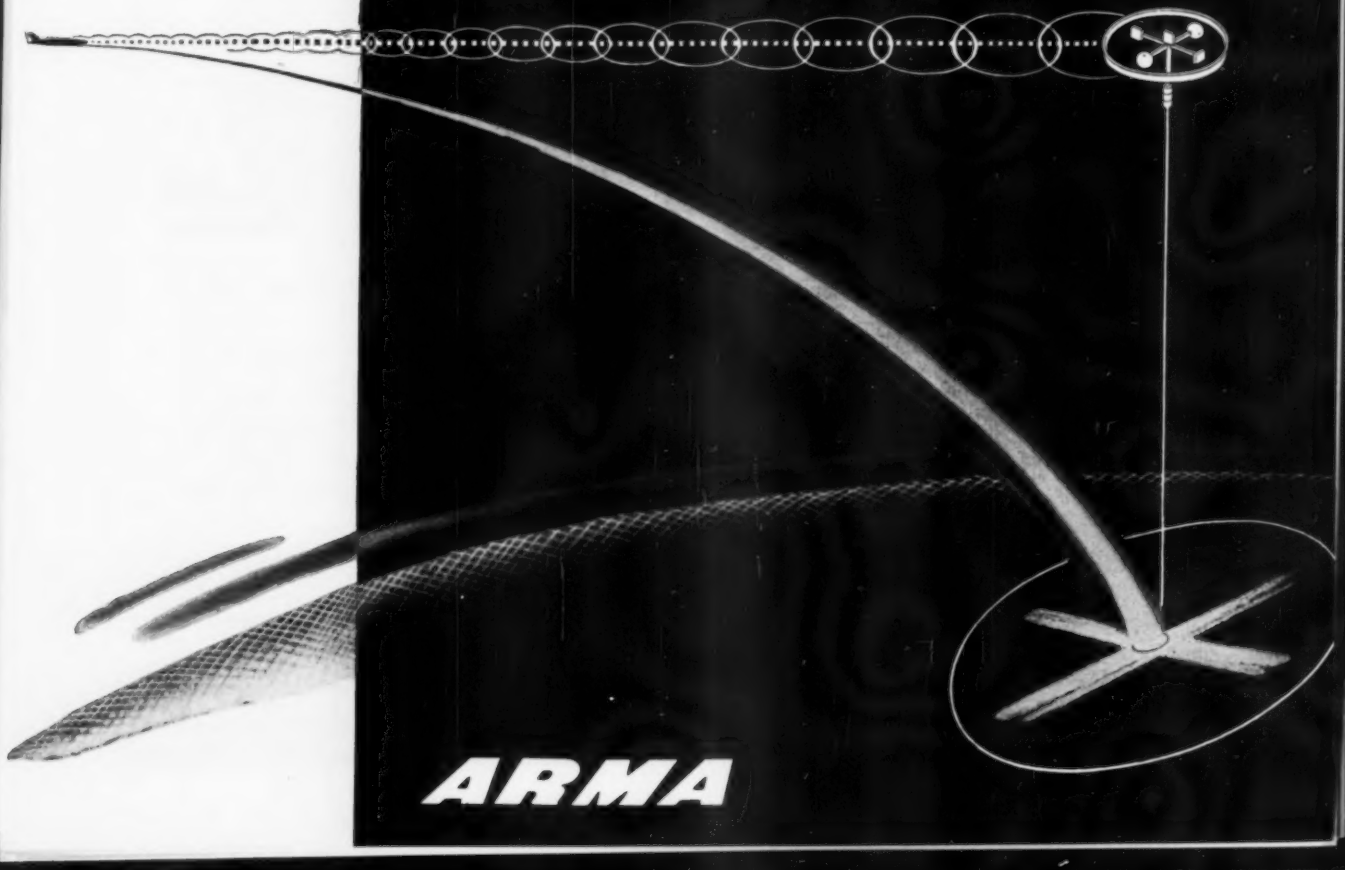

ARMA

Stock Transactions

Floyd B. Odlum, officer and director of Airflects, Inc., has disposed of his total holding of 15,099 capital shares, according to the Securities and Exchange Commission. Other transactions reported by SEC for the period June 11 to July 10:

ACF Industries Inc. Acquisition of 200 common shares by James F. Clark, officer and director, for a total holding of 700.

Allegheny Airlines Inc. Acquisition of 600 common shares by David L. Miller, officer, for a total holding of 1,402.

American Airlines Inc. Disposal of 200 common shares by Walter H. Johnson, Jr., officer, leaving a holding of 1,800.

Braniff Airways Inc. Acquisition of 200 common shares by Milton McGreevy, director, for a total holding of 2,500.

California Eastern Aviation. Disposal of 400 common shares by William W. Brinckerhoff, officer and director, leaving a holding of 82,599; disposal of 765 common shares by Edward A. Kerbs, director, leaving a direct holding of 5,870 and no indirect holding.

Capital Airlines Inc. Disposal of 1,900 common shares by James W. Austin, officer, leaving a holding of 12,046; disposal of 650 common shares by J. B. Franklin, officer, leaving a holding of 3,350; disposal of 200 common shares by Robert J. Wilson, officer, leaving a holding of 398; disposal of 1,000 common shares by Robert P. Wright, officer, leaving a holding of 575; acquisition of $50,000 of 4½ pc convertible debentures by Thomas D. Neelands, Jr., director, his total holding.

Eastern Air Lines Inc. Acquisition of 100 common shares by Robert Ramspeck, officer, for a total holding of 220.

Electronics Corp. of America. Disposal of 13,950 common shares by John A. Long, officer and beneficiary, leaving a direct holding of 16,000 and an indirect holding of 121,000; disposal of 13,950 common shares by Arthur G. Metcalf, officer, director and beneficiary, leaving a direct holding of 15,999 and an indirect holding of 121,000.

Emery Air Freight Corp. Acquisition of 100 common shares by A. M. MacIver-Campbell, officer, for a total holding of 1,300; acquisition of 250 common shares by Horatio J. Snyder, officer and director, for a total holding of 5,050.

Flying Tiger Line Inc. Acquisition of 200 common shares by James E. Davidson, director, for a total holding of 200.

General Electric Co. Acquisition of 690 common shares by Fred J. Borch, officer, for a total holding of 997; acquisition of 1,138 common shares by William R. Herod, officer, for a total holding of 8,006; acquisition of 2,300 common shares through exercise of option by Roy W. Johnson, officer, for a total holding of 9,026; acquisition of 1,070 common shares by Ray H. Luebbe, officer, for a total holding of 4,320; acquisition of 297 common shares by Harold A. Olson, officer, for a total holding of 2,010; acquisition of 9,675 common shares by Robert Paxton, officer, for a total holding of 17,277; acquisition of 1,875 common shares through exercise of option by Harold F. Smiddy, officer, for a total holding of 5,625; acquisition of 1,185 common shares by Arthur F. Vinson, officer, for a total holding of 4,892.

General Motors Corp. Acquisition of 2,700 common shares by Donaldson Brown, director, for a direct holding of 85,500 and indirect holdings of 335,931; disposal of 1,200 common shares by John F. Gordon, officer and director, leaving a holding of 5,076; disposal of 231 common shares by Charles G. Stradella, director, leaving a holding of 13,607.

Goodyear Tire & Rubber. Disposal of 100 common shares by A. G. Cameron, director, leaving a holding of 10,486; disposal of 3,000 common shares by P. W. Litchfield,

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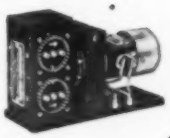

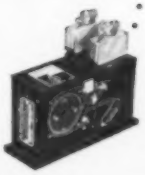

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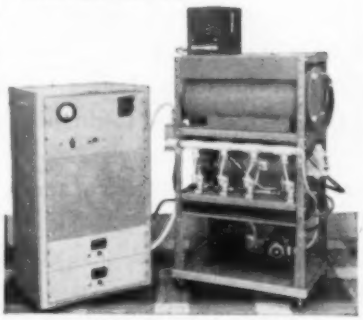

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director, leaving a holding of 44,567.

Grumman Aircraft Engineering Corp. Disposal of 3,500 shares by Albert P. Loening, director, leaving a holding of 35,000.

Lockheed Aircraft Corp. Acquisition of 100 common shares by Willard W. Keith, director, for a total holding of 500.

Minneapolis-Honeywell Regulator Co. Disposal of 1,700 common shares by C. B. Sweatt, officer and director, leaving a direct holding of 74,820 and an indirect holding of 9,230; disposal of 300 common shares by H. W. Sweatt, director, leaving a direct holding of 85,390 and an indirect holding of 7,030; disposal of 100 shares by A. M. Wilson, officer and director, leaving a holding of 3,419 and an indirect holding of 300.

National Airlines Inc. Acquisition of 500 common shares by Daniel R. Topping, director, for a total holding of 2,000.

Northrop Aircraft Inc. Disposal of 110 common shares by A. E. Ponting, director, leaving a holding of 110.

Northwest Airlines Inc. Acquisition of 500 common shares by Morton H. Fry, director, for a total holding of 1,000; acquisition of 500 common shares by Wheelock Whitney, director, for a direct holding of 800 and indirect holdings of 1,700.

Pacific Northern Airlines. Acquisition of 1,000 common shares by Paul Porzelt, director, for a total holding of 2,000.

Pan American World Airways Inc. Disposal of 1,000 capital shares by Harold M. Bixby, director, leaving a holding of 8,095; acquisition of 214 capital shares by Everett M. Goulard, officer, for a total holding of 345; disposal of 891 capital shares by C. M. Young, officer, leaving a holding of 2,500.

Seaboard & Western Airlines Inc. Acquisition of 100 common shares by Harold Montee, officer, for a total holding of 13,272.

Slick Airways Inc. Acquisition of 200 common shares by Henry P. Huff, Jr., officer, for a total holding of 1,400.

Solar Aircraft Co. Acquisition of 100 common shares by Herbert F. Sturdy, director, for a total holding of 100.

Sperry-Rand Corp. Disposal of 154 common shares by Herbert H. Goodman, officer, leaving a holding of 100; disposal of 5,000 common shares by Leslie R. Groves, officer, leaving a holding of 8,010; disposal of 300 common shares by Harry Landsiedel, officer, leaving a direct holding of 13,904 and an indirect holding of 35,600; disposal of 17,734 common shares by Bernard O. Reuther, officer, leaving a holding of 39,000.

Trans World Airlines Inc. Disposal of 200 common shares by E. O. Cocke, officer and director, leaving a holding of 1,224.

United Air Lines Inc. Disposal of 250 common shares by Rexford E. Bruno, officer, leaving a holding of 589; disposal of 261 common shares by A. M. de Voursney, officer, his total holding; disposal of 300 common shares by Charles F. McErlean, officer, leaving a holding of 1,001.

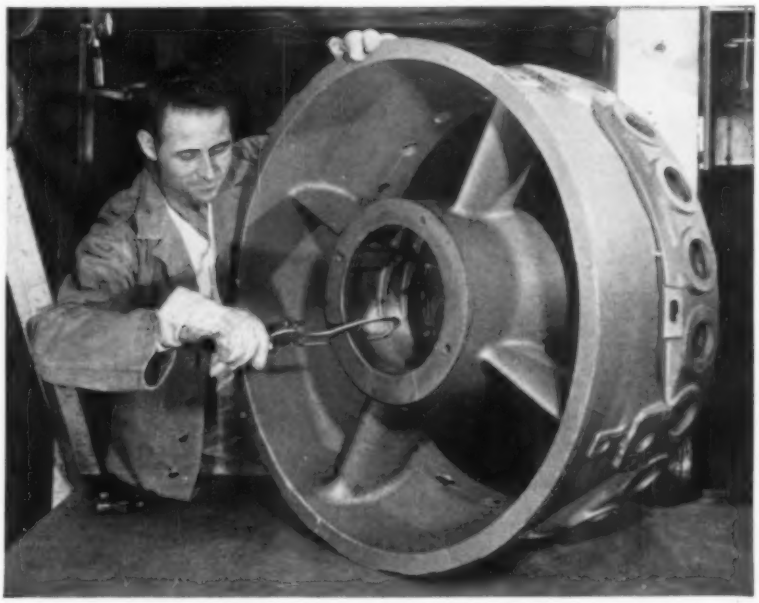
Western Air Lines Inc. Disposal of 300 capital shares by G. G. Brooder, officer, leaving a holding of 1,500; acquisition of $83,000 of 4¼% convertible sub debentures by William S. Bartman, director, for a direct holding of $50,000 and an indirect holding of $33,000.

Certificates of Necessity

Northrop Aircraft Inc., Hawthorne, Calif., has been awarded a $5,709,000 certificate of necessity for rapid tax amortization by the Office of Defense Mobilization for a facility for research and development. Of the total amount, 65 per cent is allowed at the accelerated rate. Other certificates awarded:

Lockheed Aircraft Corp. has been awarded three certificates of necessity for accelerated tax amortization totaling $5,604,755 by the Office of Defense Mobilization. Two certificates are for

QUALITY MAGNESIUM CASTINGS



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This is the "business end" of a shock tunnel. The photograph illustrates its use to obtain data on hypersonic flight . . . data which will be needed to engineer intercontinental missiles. The shock tunnel was conceived by a Cornell Aeronautical Laboratory engineer six years ago and was initially developed under a self-supported internal research program, and later by Air Force contract. Today the tunnel has become a basic tool for the study of high-speed gas dynamics.

The hypersonic program is one of the 160 technical research projects that are currently in progress at C. A. L. These projects deal with almost every area of research related to the challenging problems of modern flight. Electronics, materials, atmospheric physics, weapon systems, and applied mathematics are among the many stimulating areas of research available at C. A. L. for the professional man with an inquisitive mind.

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military aircraft facilities in Palmdale and Burbank, Calif. A certificate for $996,259 was awarded for research and development facilities in Van Nuys, Calif., at the Missile Systems Division. Of the total amount, 65% is allowed at the rapid rate.

Other certificates awarded for the period Aug. 23 through Sept. 19:

Solar Aircraft Co., San Diego, Calif., military aircraft engines, $1,548,245 certified with 65% allowed.

Burroughs Corp., Whiteland, Pa., research and development, $1,264,690 certified with 40% allowed.

Cambridge Thermionic Corp., Cambridge, Mass., electronic equipment, $7,020 certified with 70% allowed; electronic equipment, $2,810 certified with 70% allowed.

Scintilla Div., Bendix Aviation Corp., Sidney, N. Y., military aircraft parts, $46,627 certified with 65% allowed.

Stiger Precision Products, Inc., Chicago Ill., military aircraft parts, $24,921 certified with 70% allowed.

Northrop Aircraft, Inc., Hawthorne, Calif., military aircraft, $79,101 certified with 65% allowed.

Hughes Aircraft Co., Culver City, Calif., military electronics equipment, $511,238 certified with 65% allowed.

Titanium Metals Corp. of America, Brackenridge, Pa., titanium processing facilities, $3,000,000 certified with 65% allowed.

Motorola, Inc., Phoenix, Ariz., research and development, $35,713 certified with 40% allowed.

Bendix Radio Division, Bendix Aviation Corp., Baltimore, Md., electronic equipment, $72,532 certified with 65% allowed.

Aviation Fuel Terminals, Inc., Beaufort, N. C., oil storage facilities for the armed services, $90,000 certified with 65% allowed.

Norge Division, Borg-Warner Corp., Muskegon Heights, Mich., military aircraft parts, $110,227 certified with 65% allowed.

General Precision Laboratory, Inc., Pleasantville, N. Y., research and development, $25,981 certified with 65% allowed.

General Dynamics Corp., Convair Division, San Diego, Calif., research and development, $1,736,295 certified with 60% allowed.

Boeing Airplane Co., Seattle, Wash., military aircraft, $2,500,000 certified with 60% allowed.

Minneapolis-Honeywell Regulator Co., Pinellas Co., Fla., control systems for aircraft, $3,299,900 certified with 60% allowed.

Mallory Sharon Titanium Corp., Trumbull Co., Ohio, titanium fabricating facilities, $190,473 certified with 65% allowed; $1,237,885 certified with 90% allowed.

Fairchild Guided Missiles Division, Fairchild Engine & Airplane Corp., Nyandanch, N. Y., military aircraft, $15,585 certified with 65% allowed.

Ryan Aeronautical Co., San Diego, Calif., military aircraft parts, $15,829 certified with 65% allowed.

Hufford Machine Works, Inc., El Segundo, Calif., military aircraft parts, $206,240 certified with 60% allowed.

Hartman Electrical Mfg. Co., Mansfield, Ohio, relays for military aircraft, $214,225 certified with 45% allowed.

Electronic Engineering Co. of Calif., Santa Ana, Calif., research and development, $500,000 certified with 45% allowed.

Curtiss-Wright Corp., Quehanna, Pa., research and development, $30,000 certified with 60% allowed.

Boeing Airplane Co. Orders KC-135 Parts

Niles, Mich.—Boeing Airplane Co. ordered ailerons and spoilers for KC-135 jet tanker from Kawneer Co. of Niles, fabricator of aluminum. Quantity and production rate was not disclosed. Work will start toward end of 1957 first quarter when initial Boeing order for KC-135 parts is completed.

OPTICS?

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IATA Technical Committee Report:

IATA Urges Better Inspection Methods

(This is the second part of the full text of the IATA Technical Committee report, first installment of which appeared in Aviation Week, Oct. 15. Signed by Anselme Vernieuwe of Sabena, committee chairman, the report was delivered at the 12th general meeting at Edinburg.)

One of the most interesting discussions held during our technical conference in San Remo was an exchange of views on aircraft structural problems experienced in service and inspection techniques employed.

I will not attempt to summarize the discussion that took place on this highly specialized subject—to do so would be impossible. I would, however, like to put the importance of this subject into its proper perspective and in doing so to refer back to certain work done about a year ago by a study group of the Technical Committee. The task of this group was to develop the airline point of view with respect to the optimum method of safeguarding against fatigue of aircraft structures.

One of the findings of the group was that economic penalties associated with the design of aircraft free from catastrophic fatigue failure could best be minimized, without depreciating the safety of the aircraft, by employing structures in which any crack or fracture would progress sufficiently slowly that its presence would be noticed on routine inspection before the aircraft as a whole was endangered. The reason I mention the development and acceptance of this design philosophy is that it so clearly indicates that operators should leave no stone unturned in the development of newer and more efficient inspection methods and techniques.

To date we have depended largely on visual inspection involving keen eyesight, magnifying glasses, mirrors, flashlights, etc., to detect the various defects that continually occur in aircraft structures. As is well known, it is impossible to inspect all parts of the airframe structure "in situ" using this method. It is often necessary to disassemble major portions of the aircraft just to make sure that nothing is going wrong inside. Usually the structure is found to be perfectly sound and in a sense all the work of taking the aircraft apart and putting it back together has been wasted. Not only is this wasteful of maintenance man hours, but of even greater significance is the fact that the aircraft is kept out of revenue earning service for considerable periods of time—a factor which is becoming increasingly important with newer extremely high priced aircraft.

From the above considerations it becomes immediately apparent how important it is that airlines and manufacturers investigate every possible means at their disposal to increase the dependability and efficiency of inspection methods and techniques, and that a complete exchange of information and "know-how" be established. It is my opinion that no better opportunity than this type of meeting could possibly exist for such an exchange.

As stated previously, it is impossible to summarize an exchange of views. I would, however, like to comment on the attitude of the meeting towards the various inspection methods or inspection tools used by airlines in detecting defects in aircraft structures, e.g. visual inspection, use of dye

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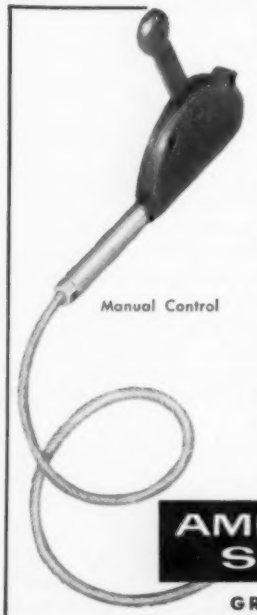

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Red-hot and cool! Convair's new F-102A plays an important part in our air protection, and Harrison keeps important engine parts running cool! Only inches away from sky-high jet temperatures, vital components operate at just the right levels for peak performance.

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It was unanimously agreed that of these methods no one could be considered as being either 100% reliable or the best method to be used in all cases. It was agreed, too, that there was a considerable degree of overlap in the use to which many of these tools could be put. In general, therefore, it was held that they should be considered as complementary means of covering a very broad field, and that complete faith should not be placed in any one method.

In conclusion I would like to echo the hope expressed by the meeting that the exchange of views which took place on this subject in San Remo would mark the first of many similar discussions to follow, and that through such exchanges of experience our inspection departments would be able to perform their task with increasing dependability and efficiency and thus fully justify the trust placed in them by the entire industry.

COMMUNICATIONS MATTERS

Communications is a service which affects every phase of airline operation and, for that reason, a good deal of what I have to report to you on both communications and radio navigational aids is more appropriately covered by other headings—notably under Air Traffic Control and Regional Affairs. For example, in last year's technical report, Mr. Dupré emphasized the growing importance of radiotelephony in aeromobile communications, and this year, the related radiotelephony progress that I have to report will be covered in my regional section. However, I have selected three communications matters which I believe will be of interest to you, and the first of these is of an organizational character.

The members of your Technical Committee have for some time been becoming more and more appreciative of the fact that, in the complex field of communications and radio aids in general, it is necessary to look quite far to the future and plan to circumnavigate many difficulties before they have actually made their presence felt in day-to-day operations.

On an individual airline basis, such future planning work and the placing of all known problems in their true relative positions of importance is done by your communications executives, and we felt in need of similar guidance and assistance at the industry level. Consequently, we have constituted a small Communications Advisory Committee—more generally known as COMAC. The group consists of eight experienced airlines communications executives who are advising us on work program matters and the desirability of participation in such non-IATA communications activities as are of importance to civil aviation. In other words, they are watching the best interests of all our member airlines insofar as radio matters are concerned and developing the specialized perspective which constitutes invaluable guidance to the Technical Committee.

Late in 1955, we held a world-wide communications meeting to develop a set of preferred characteristics for an aeromobile Single Sideband High Frequency communications system. This technique for communications—more generally known as SSB—has for some years been used successfully in certain ground point-to-point communications. Its inherent advantages are that a given SSB communications channel occupies only half as much spectrum space, while intelligibility and signal strength are appreciably improved—especially in the face of certain types of propagation disturbance. Quite apart from the many technical problems that had to be solved in the laboratory before SSB techniques could be applied to airborne equipment, it has been necessary to evolve a plan that will permit a progressive transfer from our present techniques of HF communications to the SSB mode, and this now appears to be entirely practicable if the approach developed at the IATA SSB compatibility meeting is endorsed internationally by states. To this end, we have communicated our proposals to ICAO, and the whole subject will be considered by the ICAO 6th Communications Division, which is due to meet in the latter half of 1957.

The final communications matter on which I would like to report has already been touched on earlier in connection with Air Traffic Control—and that is the need for increased simplification in communications procedures.

A special study of this subject was made during the 9th Technical Conference, and

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. . . and nine of the 19 companies receiving meritorious safety awards for having flown one million or more miles without an accident or an injury were Airwork customers.

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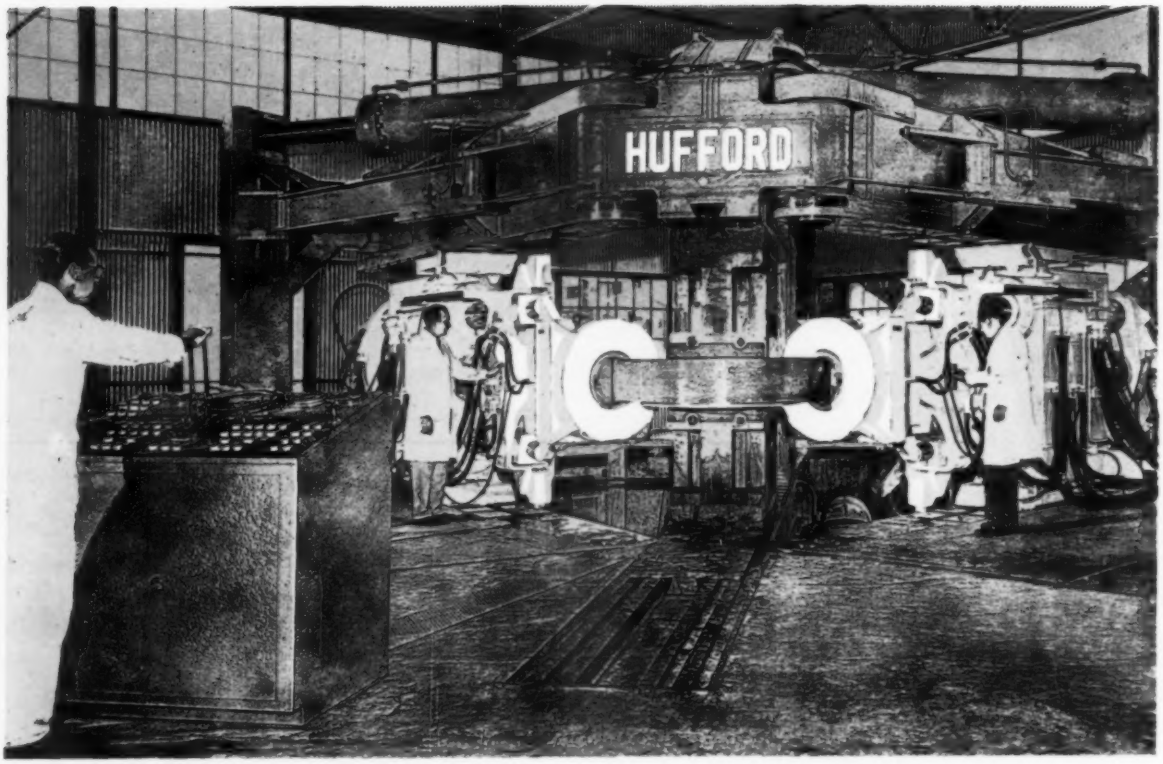

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This giant Rohr machine is one of the two largest of its kind in the world. It permits the forming of an increasing variety of large size stringers, stiffeners, skins and fillet fairings . . . it makes possible the forming of deep outsized contoured parts considerably beyond the capacity of standard stretch machines and conventional presses.

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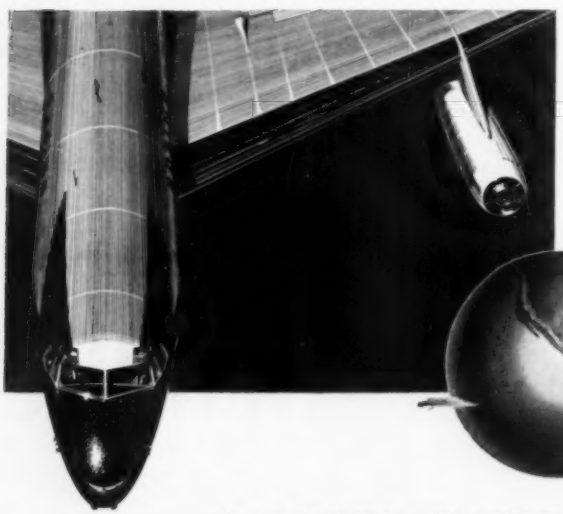

In addition to the Boeing KC-135 shown here, Rohr builds power packages for many other leading commercial and military planes which have made Rohr famous as the

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SAFETY

I am pleased to say that, although similar items have appeared on past conference agendas, on this occasion all participants were fully aware of the need to reduce by every practical means the loading of aeronautical mobile channels. Substantial progress was achieved in recommending methods to simplify message constitution, especially with respect to those categories of message that occur most frequently on the air-ground channels. Particular emphasis was placed upon the simplification of aircraft position reports and the elimination of the high degree of redundant meteorological information which is often sent to aircraft in flight.

AIRBORNE WEATHER RADAR

Last year, my predecessor reported to you that the question of airborne radar was a subject of growing interest among IATA members. Since then a number have already installed such equipment and are rapidly gaining experience with it in everyday operations. Many airlines are known to be planning programs of installation of this aid, all of which prompted us at our last technical conference to have a frank exchange of views between airlines and equipment manufacturers. In a report of this length I could not possibly summarize what we learned and what equipment manufacturers discovered were our needs. However, there are a few points arising out of the discussions which stand out above others, and I feel you should hear about them in your own interests.

The tangible advantages that have accrued to those companies which already use this storm warning radar are several. Its use has helped avoid delays due to thunderstorms, eliminated lengthy detours and saved flight time, reduced maintenance needs due to hail and lightning strikes, and minimized structural damage due to turbulence.

In intangible terms, the equipment has the advantage of passenger reassurance, reduction in passenger incidents during flight, increase in the crews' "tranquility of spirit," and advertising value. It has also reduced cockpit workload significantly under storm conditions, owing to fewer divergencies from the intended tracks, resulting in fewer requests for clearances for alterations in flight plans, thereby lessening the volume of air-to-ground communications.

The equipment can be put to a number of other uses secondary to its main function of storm detection and avoidance. These include navigation and making land falls, terrain clearance, detection of ships at sea, etc.

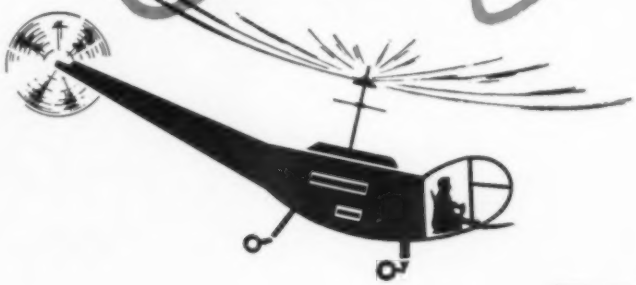
It is not surprising, therefore, that there is much airline interest in this equipment, and that substantial orders have been placed with manufacturers.

METEOROLOGICAL SERVICES

Last year, my predecessor reported to you fully on the developments in the field of meteorology which were of close interest from the airlines' viewpoint, i.e., on the completion of the ICAO Meteorological Annex to the Chicago Convention, and of the ICAO Meteorological Procedures for Air Navigation Services. You were also

GIVE IT A

Whirl



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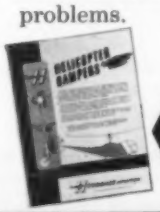

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What happens to metals at 25,000 m.p.h. 200 miles up?

General Mills scientists are finding some of the answers to this question, which bears directly on space ships and man-made satellites.

Their findings indicate that materials to be sent into space must possess properties not found in today's ores and alloys. Since few new metals remain to be discovered, they conclude that present ones must be given new properties to cope with the heat barrier and to keep vehicles from disintegrating under particle bombardment.

The study of metals in space flight represents but a single phase of General Mills' over-all program of advanced exploration in theoretical and developmental physics.

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SAFETY

told that your meteorological and operational specialists spent much time and effort in evolving the principles for the supply of meteorological information to aircraft in flight, principles which would meet the requirements of long range as well as of short range operations. You may recall that, under the new system proposed:

• **Routine meteorological** information, such as hourly observations and airport forecasts for certain terminals, would be given to a pilot by the air traffic services, whenever he so requested. In areas with high traffic density, this information should be put out on a regular basis by scheduled broadcasts, so that the pilots could intercept the particular information they required and thus avoid overloading of available aeromobile channels by multiple individual requests.

• **Non-routine meteorological** information of particular significance to an aircraft (such as severe icing conditions) should be transmitted to the pilot in flight by the air traffic services when, and as, they considered such information would concern the operation and safety of the aircraft.

• **Routine and non-routine** information would also be given to a pilot in flight by certain ground communications stations when he requested such information from them, or when his airline desired to direct to him meteorological data of relevance for his decisions about the conduct of the flight.

METEOROLOGY

Since then, the efforts of your meteorological and operations specialists have been devoted to the application of these principles, and to the problems associated with the supply of meteorological information to aircraft in flight using radiotelephony. Though there are still some minor differences between the methods recognized by ICAO and those sought by IATA, a good deal of progress towards our objectives has been achieved in the CAR, PAC and EUM Regions.

Your EUMEAFI Technical Panel prepared a detailed outline of requirements, listing, for each regular airport, meteorological information in respect of other regular and alternate airports in the region, which should be readily available on a routine basis so that the air traffic services or the communications stations may supply it to the pilot whenever he so requests. To back this "request/reply" system, IATA also prepared a plan of VHF VOLMET Radiotelephony broadcasts for Europe, and it is gratifying to note that the value of this work has been recognized by many states, which have implemented in a number of cases IATA proposals, even though they are not yet embodied into the ICAO regional plan.

Since a large number of our member airlines already use radiotelephony as the primary means of communications along their routes, much remains to be done in establishing effective regional plans for the supply of meteorological information to aircraft in flight relying on radiotelephony as the sole communications mode. In this respect, IATA is now devoting its attention to the Southeast Asia Region, where our

Performance proved in flight
More light planes are equipped with Sensenich Propellers than any other make.
FIXED PITCH METAL
CAA approved up to 165 hp.
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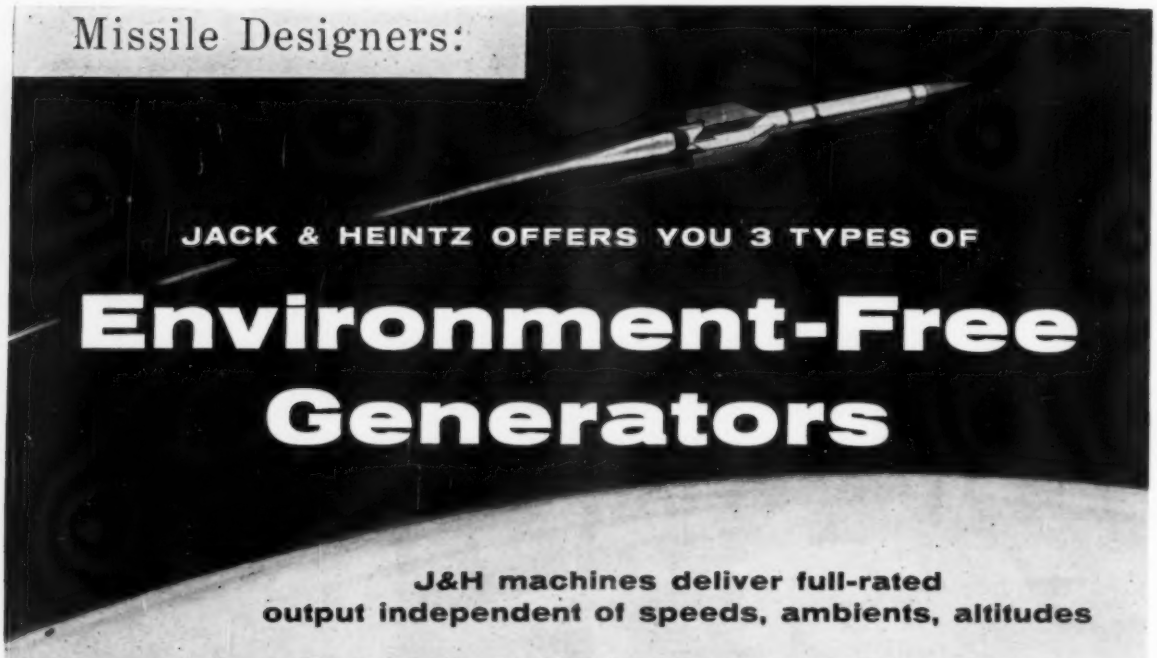
WILLIAM R. DAVLIN, *Secretary*
DEPARTMENT OF COMMERCE
COMMONWEALTH OF PENNSYLVANIA
HARRISBURG, PENNSYLVANIA

Missile Designers:



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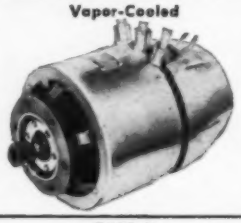
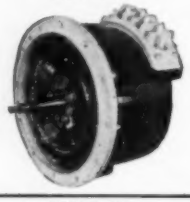
Representative J&H Generator Designs for Missiles	Vapor-Cooled 	Oil-Cooled 	Thermal Lag
J&H Model	G188-5	31190-005	31186-001
Nominal Rating (kva)	30	40	10
Duty	continuous	continuous	intermittent
Volts	120	120/208	120/208
Speed (rpm)	12,000	6,000	12,000
Phase	3	3	3
Frequency (cps)	400	400	400
Power Factor (minimum)	.8	.75	.9
Weight (lb)	66	75	29.5
Length (in.)	13	9	10
Diameter (in.)	9	9.75	7

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planning is made opportune by an ICAO Air Traffic Control meeting to be convened in early autumn.

HELICOPTERS

A year ago, the work being done by our Helicopter Group was reported to you. At that time the group had just completed the first phase in its development of tentative policy with respect to certain priority problems.

It is now my pleasure to advise you that another step forward has been taken in connection with this work, through the convening of an industry-wide meeting in San Remo just prior to the 9th Technical Conference. The primary purpose of this meeting was to obtain the views of other branches of the industry with respect to the tentative positions which we had previously established before giving them full policy status.

A comprehensive report of this meeting has been produced, but I would like to mention a few of the highlights here which I know will be of particular interest to you. To start with, the operators were clear in stating their requirements for two types of multi-engined transport helicopters—one a 25-passenger machine, and the other for about 40-50 passengers. The smaller aircraft should have a cruising speed of 100-125 mph. for metropolitan type operations (in and around cities) and 150 mph. for inter-city routes. The range of such an aircraft should be at least 100 mi. with normal fuel reserves. The direct operating cost should not exceed 10 cents per available seat mile. The 40-50 passenger aircraft, which would be used largely for inter-city operations, should have a cruising speed of 150 mph. with a range of 200 mi. (including normal fuel reserves) and a direct operating cost per available seat mile of not more than 6-7 cents.

In thus stating their requirements for future transport helicopters, the operators stressed the fact that the performance and handling characteristics of these aircraft must be such as to permit safe economic operation into and out of 200 × 400-ft. takeoff and landing areas located in city centers. It was recognized that at many heliports there may be more than this space available, but it was the consensus that the helicopter would never realize its full potential until it could meet the 200 × 400-ft. requirement as stated.

The manufacturers were optimistic concerning their abilities to produce helicopters that would meet all the operators' requirements. Twenty-five passenger machines of the type specified would, they said, be available in three to five years. Larger aircraft of the 40-50 passenger category were in current development and could be made available about five years after a decision was taken to go ahead with production.

Another point emphasized by the meeting was the requirement for adequate heliport facilities, particularly in large metropolitan areas. Specific guidance to city planners was agreed with respect to obstruction clearance profiles required in addition to the 200 × 400-ft. takeoff and landing area mentioned above. It was held to be most important that responsible city ad-

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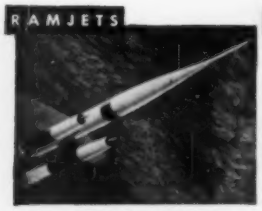

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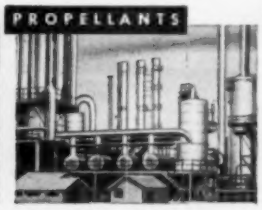

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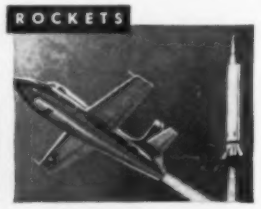

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ministrations make provision in their current planning for future heliport sites and that they adopt suitable zoning laws to protect approach paths to the heliport.

On the performance side, operators were very pleased to hear from certain manufacturers that economic multi-engined transport helicopters, capable of hovering with one engine inoperative with full payload, would be made available in 3-5 years. The potential opened up a whole new horizon of operating techniques. It was agreed that safe economic operations could be conducted without this ability, although with the development of suitable techniques, it was most desirable from the point of view of attaining regularity of schedules under low visibility conditions and of expediting traffic at congested heliports.

HELICOPTER OPERATIONS

There was agreement that a need existed for administrations to take into consideration future helicopter operations in all ATC advance planning. Such plans should be based on the concept of segregating helicopter and fixed-wing operations to the maximum extent possible. This, it was agreed, could probably best be achieved by the provision of special helicopter airways.

The requirements for accuracy of helicopter navigational aids, as developed by a previous IATA helicopter meeting (Brussels, February 1955), were agreed in principle. It appeared that one navigational aid of the area coverage type was basically capable of meeting these somewhat exacting requirements and that flight trials had tended to confirm this point.

It was considered encouraging that trials had indicated the practicability of using the same aircraft coverage type aid for instrument approach purposes. This was recognized to be important when considering the many different heliports, which are likely to exist in a given area, and the cost of equipping them separately with an approach aid. It was agreed that, for maximum regularity of operation, a specialized aid including a glidepath would probably be required. Ground radar, it was reported, had been tried and could be used subject to suitable action being taken to overcome the problem of permanent echoes from buildings and other obstructions. It was reported, too, that a ground based doppler system under current development might have application to this problem.

On the subject of communications, it was noted that there were certain difficulties associated with UHF and VHF systems because of their line-of-sight limitations. It was recognized that these could be overcome in some cases by suitable siting and additional ground stations—but only at some cost both in money and operational complexity.

In conclusion, I would say it was significant that the predominant theme running through this meeting was the urgent necessity to produce a sufficiently economic helicopter to enable it to compete on level terms with other forms of transport. Whilst manufacturers indicated with some optimism that they could meet the requirement of the operators in this respect within the next few years, it was clear to everybody that the combined effort of operators, manufacturers and administrations would be necessary to achieve the overall objective.

REGIONAL AFFAIRS

The past year has seen a general intensification of regional activities. Everywhere the need for better facilities and expanded services increases with the volume of international traffic, and IATA's effort in the field of regional affairs grows proportionately.

Full scale ICAO Air Navigation meetings have been held for the Pacific and Caribbean Regions. At both meetings, IATA carefully prepared and presented an impressive list of airline requirements, and the results—in terms of plans approved—have been gratifying. Undoubtedly the placing by airlines of firm contractual commitments for jet aircraft has imparted a certain stimulus to the planners, and I am able to report that their plans can be regarded as forming a satisfactory framework on which to base our operations at least until 1960.

A third Air Navigation meeting, of a limited nature, was held last February to deal with current problems of Air Traffic Control over the North Atlantic. Here we have something of a special problem in that transocean traffic, rapidly increasing, is fast saturating the airspace available.

No radical improvement can be expected until navigational aids of greater range and reliability are devised and installed, and until the present aeronautical mobile and point-to-point telecommunications facilities

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are improved to give reliable and rapid communications between aircraft in flight and the ground, and also instantaneous speech circuits between the oceanic Air Traffic Control Centers.

Before that, we cannot anticipate any significant reduction in the large protective "boxes" of airspace around each transatlantic aircraft. We must, therefore, rely on other measures to expedite traffic: improving existing facilities, streamlining procedures and exploiting all known communications techniques. This was the prime motive of the recent special meeting of North Atlantic states which was convened largely at the instigation of IATA.

IATA regional activity in Europe, Africa and the Middle East continues to receive a large share of attention. The EUMEAFI Technical Panel and the various local panels associated with it have energetically applied themselves throughout the year to the task of determining new and revised airline needs, and obtaining their acceptance through negotiations both within ICAO and with individual national administrations. The panel has determined complete airline requirements for VOR stations throughout Europe, Africa and the Middle East, while at the same time exerting continuous pressure towards the improvement of air routes by securing better facilities and more direct routings between terminals.

Looking into the future, ICAO will convene a fourth European Regional Air Navigation meeting in June 1957. This meeting, from the airlines' point of view, will undoubtedly be the most important ICAO RAN meeting held to date, since its planning work will have to take into account not only the complexity of the regional route structure, but also the appearance of jet transport aircraft in every major air terminal in the region. You can rest assured that all the future activity of your EUMEAFI Technical Panel will be devoted to the planning for this very important meeting.

Last year my good friend Mr. Dupré referred to the formation of an agency under the North Atlantic Treaty Organization in which the coordination of civil and military air movements could be discussed. I am pleased to report that this agency, now known as the Committee for European Airspace Coordination, is proving a valuable forum for the discussion of civil and military claims to the crowded airspace over Europe. Although many problems remain, we firmly believe that they will only be resolved through continuous consultation and co-operation and, to the end, we welcome the opportunity to state the airline viewpoint in this committee.

Asian Problems

An extension of our activities is taking place in Southeast Asia, where a series of ICAO informal meetings is currently tackling a number of air traffic and communications problems. IATA participation in these meetings is backed by fact-finding activity and sound preparation, and it is hoped that considerable benefits to the operators in Southeast Asia will result.

Plans are also in hand to step up the tempo of IATA activity in South America

to weight engineers

A. C. Robinson (left), weight group engineer in charge of research and development, discusses new solutions to problems involving effect of aerodynamic heating on structural weight with L. T. Maynard (center), Structures Division administrator, and Weight Engineer W. L. Weber.

who seek preliminary design assignments

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in order to bring facilities and services to the standards required by modern aircraft and to prepare for the advent of jet aircraft. Everywhere, in fact, it is the same story—an intensification of effort commensurate with the advance of aviation.

The use of air-to-ground radiotelephony continues to increase the world over and, in almost every region, it is now recognized as the primary means of communications. Long range communications service to air craft in flight by means of high frequency radiotelephony is today organized so that ground stations can offer each other mutual support in effecting communications with aircraft to ensure that, even under the most adverse conditions, at least one ground station will always be in contact. To achieve the best results, this organization—or "network system" as it is called—requires the ground stations and aircraft to operate on a common set of frequencies and that they work together in a defined manner. A large share of our effort in the communications field has been devoted to fostering this teamwork principle and to improving procedures in each region to accelerate the passage of intelligence. In Europe and several other areas, it has been found possible to prearrange the communications service required from the various ground stations of a network in connection with their watch over scheduled flights, and European states —with IATA's assistance and encouragement—are currently conducting trials with this system.

Radio Revisions

The current IATA concepts of HF radiotelephony network system organization, and of the "prearranged communications service" to be rendered by each network station to individual scheduled flights, indicate a need, already recognized in several areas of the world, for certain revisions of the current ICAO Annex 10 and Radiotelephony Procedures.

We believe that these revisions will help to eliminate unnecessary traffic from aeromobile channels through full familiarization of the ground stations with their respective duties towards individual flights, and consider them to be essential prerequisites towards the preparation of effective Regional HF Radiotelephony Manual(s). These manuals, in our belief, will prove to be a valuable guide to both the ground stations and flight crew personnel.

The importance of the complete implementation of regional plans agreed by states and the ICAO regions has been emphasized time and again. Last year at this time we examined this problem at some length and, in the face of penalties of growing magnitude, resolved both to impress upon state authorities the importance of implementation and also to initiate an analysis of the economic penalties suffered by airlines through lack of proper facilities. I am glad to say that airlines have responded promptly at the highest level to show how the lack of implementation is hurting us, and, although it is as yet too early to perceive whether there is likely to be any substantial improvement in the situation, I am at least able to report that the existence of the problem is now widely recognized by providers and users alike, and that it has, furthermore, be-

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come the subject of currrent studies by ICAO.

And now, let me follow the example of last year and round off my report with a brief glimpse into the immediate future. By your orders of jets you have set us a heavy task, and we all know that the next few years will probably be the most intensive ever faced by the air transport industry.

Our current work program, on which the 9th Technical Conference in San Remo had a culminating effect, already calls for a study of a number of problems related to the operation of jet transport aircraft. Many worldwide policies and solutions will have to be developed by a number of our study groups. Close contact will have to be maintained with the administrations and research establishments of a number of countries.

A lot of attention will have to be devoted to regional planning to ensure that, on the day when the jets arrive, there will be airport and ground facilities necessary to receive them and permit their safe operation.

I can therefore predict that the next year or the few years to come will be very burdensome on your IATA technical secretariat and will demand a great deal of effort on the part of your technical and operational personnel. In this respect I appeal to you: let us have your best brains; the problems before us are many and their solution of great importance, since a great deal is at stake.

CONCLUSION

In closing, I wish to pay my high tribute to the members of the Technical Committee who have guided the Association's technical activity during the past year, and also to all the other airline technical experts who, through their interest, tireless efforts and sound knowledge of the various fields of acronautics, have contributed much to our technical achievements during the past year.

I am honoured to report to you that the Technical Committee elected me to serve as its chairman for the forthcoming year, and rest assured that I will do my utmost to discharge my duties to the best of my abilities.

I wish also to inform you that I shall have the able assistance of Capt. J. W. G. James, flight operations director of British European Airways, as first vice chairman, and of Mr. S. B. Kauffman, assistant vice president and chief engineer of Pan American Airways, as second vice chairman.

My report on last year's technical activity of IATA would not be complete without a few words of appreciation for your permanent technical secretariat. The technical director, Mr. Stan Krzyczkowski—well known to all of us for his skill, experience, tact and cheerfulness—with his extremely small group of assistants in Montreal and London, has guided all our technical endeavors with careful planning and foresight, and has done much to simplify our work and save our time, even during the discussion of most involved problems. I commend and thank them for their efforts and efficiency.

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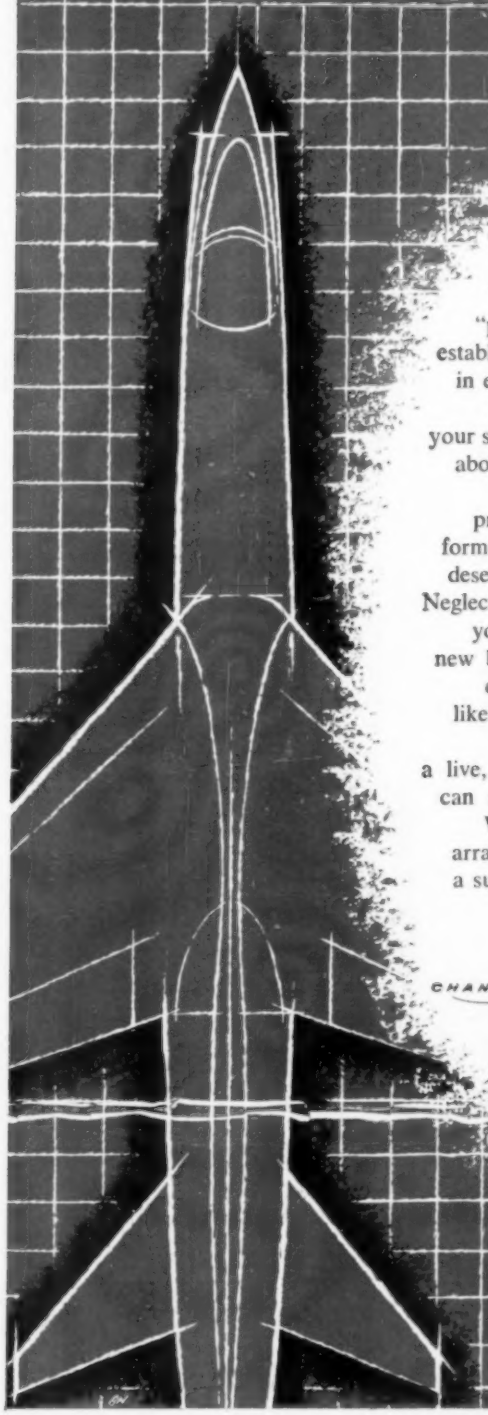

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ADVERTISERS IN THIS ISSUE

AVIATION WEEK—OCTOBER 22, 1956

AERO DESIGN & ENGINEERING COMPANY..... 26
Agency—Tom P. Gordon Co. Adv.
AIRCRAFT RADIO CORPORATION..... 14
Agency—Burke Dowling Adams, Inc.
AIRWORK CORPORATION..... 121
Agency—Gene Wyble Advertising
AMERICAN CHAIN & CABLE, AUTOMOTIVE & AIRCRAFT DIV.....130
Agency—Reincke, Meyer & Finn, Inc.
AMERICAN OPTICAL COMPANY (INSTRUMENT DIV.)..... 117
Agency—Baldwin, Bower & Strachan, Inc.
AMERICAN SEATING COMPANY (SPECIALIZED PRODUCTS DIV.)..... 118
Agency—Brooke, Smith, French & Dorrance, Inc.
APPLIED SCIENCE CORP. OF PRINCETON..... 113
Agency—Paul M. Healy Adv.
ARMA A DIVISION, AMERICAN BOSCH ARMA CORP..... 112
Agency—Doyle, Kitchen & McCormick, Inc.
AUTO-DIESEL PISTON RING CO., THE..... 86
Agency—Grover J. Johnson Adv.
AVIATION WEEK.....132, 133
BASCH COMPANY, GEORGE..... 129
Agency—Davis, Parsons & Strohmeier, Inc.
BELL AIRCRAFT CORP..... 99
Agency—Baldwin, Bower & Strachan, Inc.
BENDIX FREIZ DIV. BENDIX AVIATION CORP... 81
Agency—MacManus, John & Adams, Inc.
BOURNS LABORATORIES..... 4
Agency—Allen, Dorsey & Hatfield, Inc.
BRISTOL AIRCRAFT LIMITED.....50, 51
Agency—Young & Rubicam, Inc.
BRISTOL ENGINEERING COMPANY..... 55
CENTURY CONTROLS CORPORATION..... 86
Agency—C. M. Johnson & Associates, Inc.
CESSNA AIRCRAFT COMPANY..... 48
Agency—Gardner Advertising Co.
COLOR TELEVISION, INC.....113
Agency—Stuarco & Associates
COLVIN LABORATORIES, INC.....113
Agency—J. G. Proctor Co., Inc.
COLUMBUS DIV. NORTH AMERICAN AVIATION, INC.....134
Agency—Batten, Barton, Durstine & Osborn, Inc.
COMMONWEALTH OF PENNSYLVANIA.....125
Agency—Kastor, Farrell, Chesley & Clifford, Inc.
CONTINENTAL MOTORS CORP. (AIRCRAFT ENGINES DIV.)..... 88
Agency—The Hopkins Agency
CONVAIR, A DIV. OF GENERAL DYNAMICS CORP. (SAN DIEGO)..... Second Cover
Agency—Buchanan & Co., Inc.
CONVAIR, A DIV. OF GENERAL DYNAMICS CORP. (FORT WORTH).....114
Agency—Glenn Advertising
CONVAIR, A DIV. OF GENERAL DYNAMICS CORP. (POMONA).....135
Agency—Pacific Western Adv.
CORNELIUS COMPANY, THE..... 75
Agency—Seryniger & Osterholt Adv.
CORNELL AERONAUTICAL LABORATORY, INC...116
Agency—Barber & Pratt Adv.
DOW CHEMICAL COMPANY (FOUNDRY SALES)..115
Agency—MacManus, John & Adams, Inc.
DOW CORNING CORPORATION..... 8
Agency—Church & Griswolte, Adv., Inc.
EDO CORPORATION.....111
Agency—Davis, Parsons & Strohmeier, Inc.
ELASTIC STOP NUT. CORP. OF AMERICA..... Fourth Cover
Agency—G. M. Basford Company
ELECTRICAL ENGINEERING & MFG. CORP..... 37
Agency—West-Marquis, Inc.
ELECTRO SNAP SWITCH & MFG. CORP..... 13
Agency—Stoetzel & Associates, Inc.
ELGIN NATIONAL WATCH CO., MICRONICS DIV.. 7
Agency—Waidie & Briggs, Inc.
ENJAY CO., INC..... 71
Agency—McCann-Erickson, Inc.
FAIRCHILD ENGINE & AIRPLANE CORP.....3, 139
Agency—Gaynor, Colman, Prentis & Varley, Inc.
FAULTLESS CASTER CORPORATION.....119
Agency—Perrin-Paus Company
GARRETT CORP., AIRESEARCH MFG. DIV...108, 109
Agency—J. Walter Thompson Co.
GENERAL ELECTRIC COMPANY.....10, 11, 57, 72, 73, 87
Agency—G. M. Basford Company
GENERAL LABORATORY ASSOCIATES, INC..... 63
Agency—The Fred Riger Adv. Agency
GENERAL MATERIALS COMPANY..... 6
Agency—Ritter, Sanford & Price, Inc.
GENERAL MILLS, INC. (MECHANICAL DIV.).....124
Agency—Knox Reeves Adv., Inc.
GLADDEN PRODUCTS CORP..... 97
Agency—Weir Advertising Agency
GOODRICH CO., THE B. F. (AVIATION PRODUCTS DIV.)..... 22
Agency—Batten, Barton, Durstine & Osborn, Inc.
HAMILTON STANDARD DIV., UNITED AIRCRAFT CORP..... 20
Agency—Lennen & Newell, Inc.
HARNISCHFEGER CORP., WELDING DIV..... 69
Agency—Hoffman & York, Inc.
HARRISON RADIATOR DIV., GENERAL MOTORS CORP.....120
Agency—D. P. Brother & Co. Adv.
HOLLEY CARBURETOR CO..... 12
Agency—Holden-Chapin-Larue, Inc.
HOUDAILLE INDUSTRIES, INC. (BUFFALO HYDRAULICS DIV.)..... 123
Agency—Baldwin, Bowers & Strachan, Inc.
HUCK MANUFACTURING COMPANY..... 60
Agency—F. B. Hubert Adv.
HUMPHREY, INC..... 61
Agency—The Phillips-Ramsey Co. Adv.
HYATT BEARINGS DIV., GENERAL MOTORS CORP.....137
Agency—D. P. Brother & Company
INTERNATIONAL NICKEL CO., INC., THE..... 58
Agency—Marschalk & Pratt, Div. of McCann-Erickson, Inc.
JACK & HEINTZ, INC.....126
Agency—Fuller, Smith & Ross, Inc.
JOHNS-MANVILLE PRODUCTS.....106
Agency—J. Walter Thompson Co.
KAMAN AIRCRAFT CORP., THE.....90, 91
Agency—Charles Palm & Co., Inc.
KAWNEER COMPANY, THE (AIRCRAFT PRODUCTS DIV.)..... 68
Agency—Fuller & Smith & Ross, Inc.
KIDDE & CO., INC., WALTER..... 21
Agency—Cunningham & Walsh, Inc.
KOCH & SONS, H.....108
Agency—Wetmer, Dilleyer, Reynolds & Baker, Inc.
KOEHLER AIRCRAFT, DIV. NEW BRITAIN MACHINE CO., THE..... 98
Agency—Wilson, Haight, Welch & Grover, Inc.
LELAND ELECTRIC CO., DIV. OF AMERICAN MACHINE & FOUNDRY CO.....101
Agency—Fletcher D. Richards, Inc.
LITTON INDUSTRIES, INC..... 62
Agency—Calkins & Holden, Inc.
LOCKHEED AIRCRAFT CORP.....104, 105
Agency—Foote, Cone & Belding
LOCKHEED AIRCRAFT CORP.....131
Agency—Hal Stebbins Adv.
MARQUARDT AIRCRAFT COMPANY.....127
Agency—Heintz & Co., Inc.
MARQUARDT AIRCRAFT COMPANY (OMAR).....128
Agency—Doyle, Kitchen & McCormick, Inc.
McCORMICK SELPH ASSOCIATES.....153
Agency—Gerth-Brettle Adv. Agency
McDONNELL AIRCRAFT CORPORATION..... 77
Agency—Lemoine Skinner Jr. Adv.
MICRO SWITCH DIV. OF MINNEAPOLIS-HONEYWELL REGULATOR CO.....100
Agency—Reincke, Meyer & Finn, Inc.
NEW DEPARTURE DIV., GENERAL MOTORS CORP..... 18
Agency—D. P. Brother & Co., Inc.
NORTHROP AIRCRAFT, INC..... 38
Agency—West-Marquis, Inc.
NORTHROP ANAHEIM DIV. NORTHROP AIRCRAFT, INC..... 41
Agency—West-Marquis, Inc.
OLIN MATHIESON CHEMICAL CORP. (OMAR)....128
Agency—Doyle Kitchen & McCormick, Inc.
ORENDA ENGINES LIMITED..... 80
Agency—Cockfield, Brown & Co., Ltd.
PACIFIC DIV., BENDIX AVIATION CORP..... 96
Agency—The Shaw Company Adv.
PHEOLL MANUFACTURING CO. (AVIATION DIV.) 46
Agency—Dozier-Eastman & Co. Adv.
PHILLIPS PETROLEUM CO. (AVIATION DIV.).... 5
Agency—Lambert & Feasley, Inc.
PIONEER CENTRAL DIV. OF BENDIX AVIATION CORP..... 89
Agency—MacManus, John & Adams, Inc.
POTTER AERONAUTICAL CO..... 17
Agency—Richard A. Gumpher, Inc.
RADIO CORP. OF AMERICA.....78, 79
Agency—Al Paul Lefton Co., Inc.
REACTION MOTORS, INC. (OMAR).....128
Agency—Doyle, Kitchen & McCormick, Inc.
RESEARCH WELDING & ENGINEERING CO.....129
Agency—Dan Ehlers Adv. Service
RESISTOFLEX CORP.....138
Agency—Marsteller, Rickard, Gebhardt & Reed, Inc.
ROBINSON CO., RALPH C..... 70
Agency—Chapin-Damm Adv.
ROHM & HAAS COMPANY.....84, 85
Agency—Arndt, Preston, Chapin, Lamb & Keen, Inc.
ROHR AIRCRAFT CORPORATION.....122, 152
Agency—Barnes Chase Company
RYAN AERONAUTICAL COMPANY..... 70
Agency—Batten, Barton, Durstine & Osborn, Inc.
RYERSON & SON, INC., JOSEPH T..... 97
Agency—Calkins, Holden, Carlock, McClinton & Smith, Inc.
SEARCHLIGHT SECTION.....140 to 151
SENSENICH CORP.....125
Agency—Foltz-Wessinger, Inc.
SOCONY-MOBIL OIL CO., INC..... 13
Agency—Compton Advertising, Inc.
SOLAR AIRCRAFT COMPANY.....110
Agency—The Phillips-Ramsey Co. Adv.
SOUTHERN CALIFORNIA COOPERATIVE WIND TUNNEL.....135
Agency—The Perrett Co.
SPERRY GYROSCOPE CO., DIV. OF SPERRY RAND CORP. (MICROWAVE ELECTRONICS DIV.)..... Third Cover
Agency—Roach, Yates & Mattson, Inc.
STEWART WARNER CORP. (ELECTRONICS DIV.)..... 67
Agency—The Buchen Company
SURFACE COMBUSTION CORP. (JANITROL AIRCRAFT-AUTOMOTIVE DIV.)..... 56
Agency—Odiorne Industrial Adv.
TEXAS INSTRUMENTS, INC.....107
Agency—Don L. Baxter, Inc.
TITEFLEX, INC. (AVIATION PRODUCTS DIV.)..... 74, 75
Agency—Arndt, Preston, Chapin, Lamb & Keen, Inc.
TOWNSEND COMPANY (CHERRY RIVET DIV.)..... 64, 65
Agency—Bond & Starr, Inc.
ULLMAN PRODUCTS CORP.....153
Agency—Shevlo Adv.
UNITED STATES TIME CORP., THE.....102
Agency—Peck Advertising Agency, Inc.
VICKERS, INC., DIV. OF SPERRY RAND CORP.... 9
Agency—Witte & Burden Adv.
WESTERN GEAR CORP..... 16
Agency—Ruthrauff & Ryan, Inc.
WESTINGHOUSE ELECTRIC CORP.....92, 93
Agency—Fuller & Smith & Ross, Inc.
WHITTAKER CO., LTD., W. R..... 59
Agency—Mogge-Privett, Inc.
WICKES ENGINEERING & CONSTRUCTION CO... 70
Agency—The Roland G. E. Ullman Organization
ZENITH AIRCRAFT CO., DIV. OF ZENITH PLASTICS CO..... 19
Agency—Francis D. Gonda Co.

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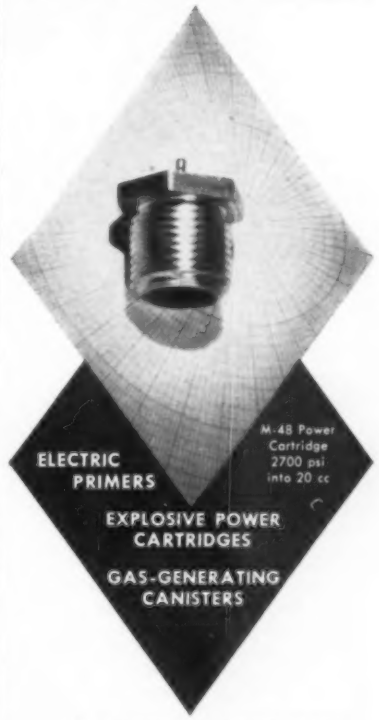

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LETTERS

ARDC Congratulations

Having been away from my office to a great extent during the past several months on official business, plus a short leave period, this is the first opportunity I have had to congratulate you and your staff on the second ARDC issue of AVIATION WEEK. The first issue several years ago was a great editorial contribution to the research and development work of the Air Force, but the second issue is an even greater contribution.

To you and all of your staff of well qualified editors I wish to express my personal appreciation for the insight and understanding you have for the research and development program in the Air Force.

D. L. PUTT
Lieutenant General, USAF
Deputy Chief of Staff Development

Scores Pilot Trainees

The mid-air collision over the Grand Canyon has certainly stirred up quite a bit of comment and I would like to add some of my own.

In regard to the anti-collision and safety factors in today's air transportation it is certainly interesting to take a look at some of the things the industry and the ALPA, the ones who profess so much concern, are doing.

Take a look at the DC-8 as presently set up. The Flight Engineer has only the aircraft system on his panel to monitor. They have placed all the engine instruments down front where it becomes the job of the two pilots to monitor them and still they talk about the increasing necessity for the pilots to give their full attention to where the aircraft is going at five or six hundred miles per hour, and what is out front. They talk safety on one hand and on the other they have made a concerted effort to minimize the job of Flight Engineer, and the thinking in the design of this aircraft certainly seems to be in this direction. Added to this is the continual harassment of the Flight Engineer with the information that the airlines and the ALPA are going to require that the Flight Engineer station on the jets be manned by a pilot-qualified engineer. For what reason? It looks like just another wedge for the ALPA to claim the Engineers as their own. The jets are going to cross the country in five hours and less. If the pilots up front cannot handle a trip of this length something is radically wrong.

The original intent of the CAA and the industry was that the Flight Engineer should be an individual to whom the mechanics of an aircraft were of prime interest. Not that in a few short months he might be over in the copilots seat and some day a captain. The United Airlines Flight Officer in his "Pilot Solution" (AW July 30, p. 102) gives another good picture of what is happening. Take a look at the training they gave him with ALMOST 200 hours of light plane time. Seventeen weeks, a little over four months, to get an instrument rating, qualify as a copilot on the Convair 340, and get a Flight Engineer certificate. Other airlines require more time than this just for the Flight Engineer ticket. Time was when it required fifteen months of school at eight hours per day just to get an Aircraft and Engine Mechanic certificate, which is still a prerequisite to becoming a Flight Engineer on many of the airlines.

The United Flight Officer with only a short ten months in the Flight Engineer seat is a long way from becoming an experienced Flight Engineer let alone being qualified to evaluate the training for copilot gained while neglecting his job as Flight Engineer.

I have been a Flight Engineer for four years, a mechanic for twelve years prior to that, I hold an A&E mechanic certificate, and Engine Ground Instructor certificate, a private pilot certificate, and a Flight Engineer certificate, and I feel that in a couple more years I'll be a fair Flight Engineer. The idea that they want to stick a pilot trainee in the Engineer's seat on the jets and still talk safety doesn't make sense to me. I suggest they read once again "The Human Side of Tomorrow's Airplane," by B. A. Martin of the Lockheed Aircraft Corporation, which was presented at the annual Engineering and Maintenance Conference of the ATC on Oct. 12, 1954 and reprinted by Flight Safety Foundation.

ROMAINE S. KNAPP
Flight Engineer, Monsey, N. Y.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Altimeter Readings

Your Aug. 20 issue has an interesting news item of recommendations of ALPA's traffic control committee to prevent collisions (p. 98).

It is proposed that the 1,000 ft. on top clearance be eliminated and that 100% Instrument Flight Rules be substituted above 9,500 or 14,500 ft. It is also recommended that accurate altimeters be developed. Well, I hope that someone comes up with the latter before ALPA puts over the 100% IFR business.

Back in your March 19 issue you were kind enough to publish a letter of mine (p. 106) dealing with jet traffic control problems. Following publication I received comments from pilots all over the country. Among the comments relayed to me were the following pertinent remarks of an Oklahoma interceptor pilot:

> ". . . my biggest concern, however, is in instrument variation. For example, we had a flight (formation) of eight F-80's from the Tulsa unit at 36,000 ft. recently when we compared altimeter readings. We found that some of the instruments differed as much as 2,000 ft. while we knew that they were all known to be within tolerable allowances on the ground."

There are times when actual instrument flight and the IFR rules can not be avoided when at 30,000 to 40,000 ft. However, I feel much more comfortable with a 1,000 ft. on top clearance (when it is possible to use it) knowing that eyes can assist in avoiding a collision, rather than to depend entirely upon the indications of my altimeter and the other fellows as the safeguard against collisions. Of course, I might be able to rely upon an airliner being at the correct altitude since an airliner has two altimeters. If either one is off a check can be made, but how about the great majority of the ships in the sky that have only one altimeter? How is the pilot to know that he may not be at the altitude that his one altimeter indicates?

ROBERT E. TRIMBLE
1708 W. Street, S. E., Wash., 20, D. C.

Seniority Ignored

Mr. Stebbin's "Company View" (AW, Aug. 20, p. 114) on hiring engineers is so obviously true that it is amazing how many companies fail to recognize the facts.

Tremendous amounts of effort and money are spent to hire college graduates, and because of the competition for these boys they are offered salaries out of all proportion to their worth, and are led to believe that they are outstanding engineers before they even start to work. As Mr. Stebbins says, many of them intend to use the company as a stepping-stone to get higher paying jobs somewhere else. Others will become disillusioned and will quit when they find out that the company cannot live up to the high promises it made or inferred when they were hired. The records will show that a comparatively small percentage of these recent graduates become permanent members of the team.

At the same time, these companies show a distressingly small amount of interest in the morale and welfare of engineers who have been in their employ for many years. Letters to AVIATION WEEK from dissatisfied engineers draw attention to the fact that there is little reward or prestige for the man who spends a decade or more with one company and continues to do engineering work. If he doesn't have the showmanship or other qualities required to be promoted out of design work into supervision, the raises he can expect will not keep up with the cost of living, and he is treated as an inferior engineer.

The company seems confident that these engineers have their roots so deep in the community that they will not quit, no matter how they are treated and, since other employers would rather hire college boys at $450 per month than 10-year engineers at $700, most of them stay on.

It should be evident that any engineering department is suffering a major loss in quality and quantity of work when the morale of its senior designers is affected by conditions such as these.

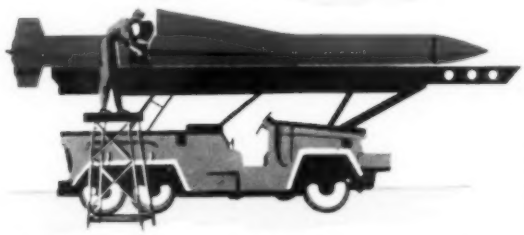
AIRCRAFT ENGINEER

1002 Before launching this missile hundreds of tests must be made — a process usually requiring several hours and highly-trained technicians.

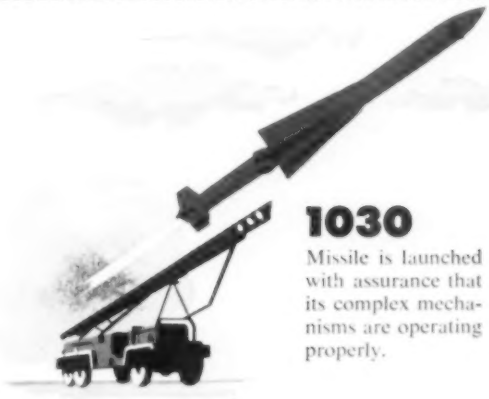
1003 Sperry Check-Out Equipment built into truck is readily moved to launching area to handle all tests.

1008 Inside truck the operator sits at console and by merely pressing button sees micro-filmed information for operational decisions on each malfunction.

1009 Pressing another button operator receives card showing adjustment or repair required and detailed instructions.



1025 With complete instructions for repairs, the check-out is rapidly and accurately completed.



1030 Missile is launched with assurance that its complex mechanisms are operating properly.

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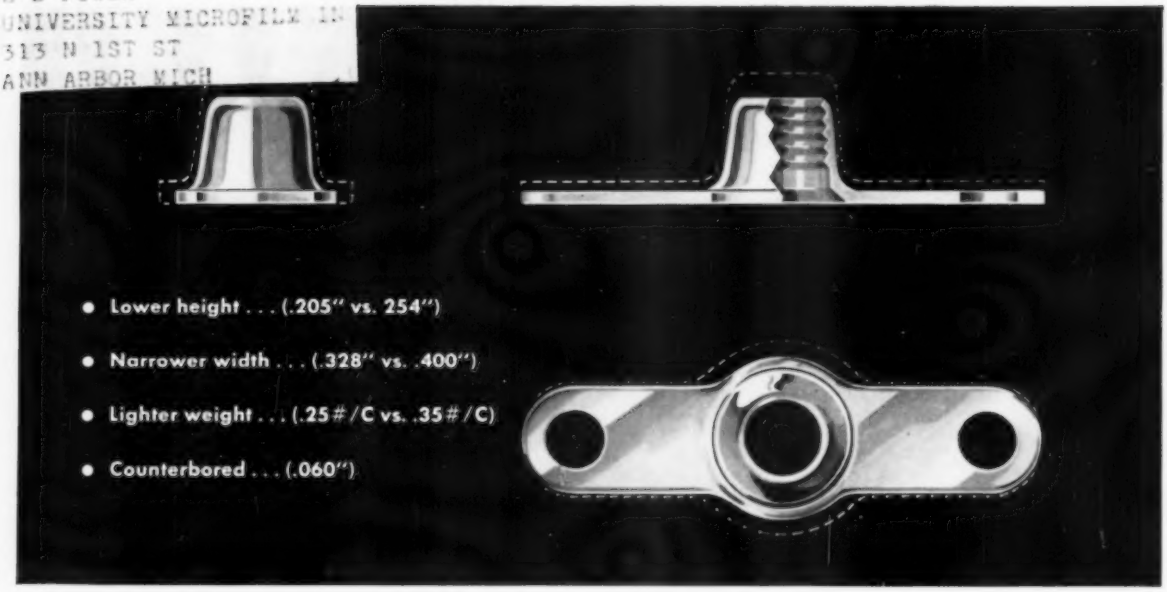

New Low-Height Counterbored Locknuts Conform with NAS Drawings

The new ESNA LHTA51 series of self-locking nuts was designed to meet the requirements of the recently released NAS679-695 drawings for low-height counterbored nuts. Intended for structural use, and developing the full tensile strength required by Spec MIL-N-25027 (ASG), they perform satisfactorily at temperatures up to 550°F. These parts have also been approved to AN-N-10 and drawings AN362 and AN366.

The LHTA51 series offers several special advantages to the designer:

Minimum envelope dimensions and weight compatible with performance to the tensile, vibration, twist-out and push-out requirements of MIL-N-25027 (ASG).

Reduced height permitting use of 160,000 psi heat treat short length NAS bolts to still further cut down weight of nut and bolt assembly.

Counterbore in the base of the nut assures that bolt threads will not be in bearing. This eliminates the weight of an extra shim in many applications.

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(#8 through 5/16")

(and others not illustrated here)

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Please send me the following free fastening information:

☐ Spec Sheets on New LHTA51 Series

☐ Here is a drawing of our product. What type of self-locking fastener would you suggest?

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Company_____

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